YOUR HEALTH AND SAFETY

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book

YOUR HEALTH AND SAFETY

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AUTHORIZED FOR USE IN
MANITOBA AND SASKATCHEWAN

GINN AND COMPANY · TORONTO

PRINTED IN CANADA

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UNIT I

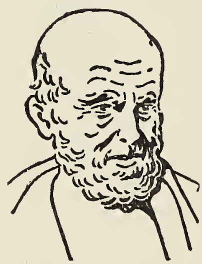
Exploring the Body

Have you ever read stories about people who set out to explore a strange country? In learning about the human body you will read about another great exploring trip. Two great sciences are based on the adventures of people who have explored the body.

DO YOU KNOW

The names of these two sciences?

What the word *science* means?

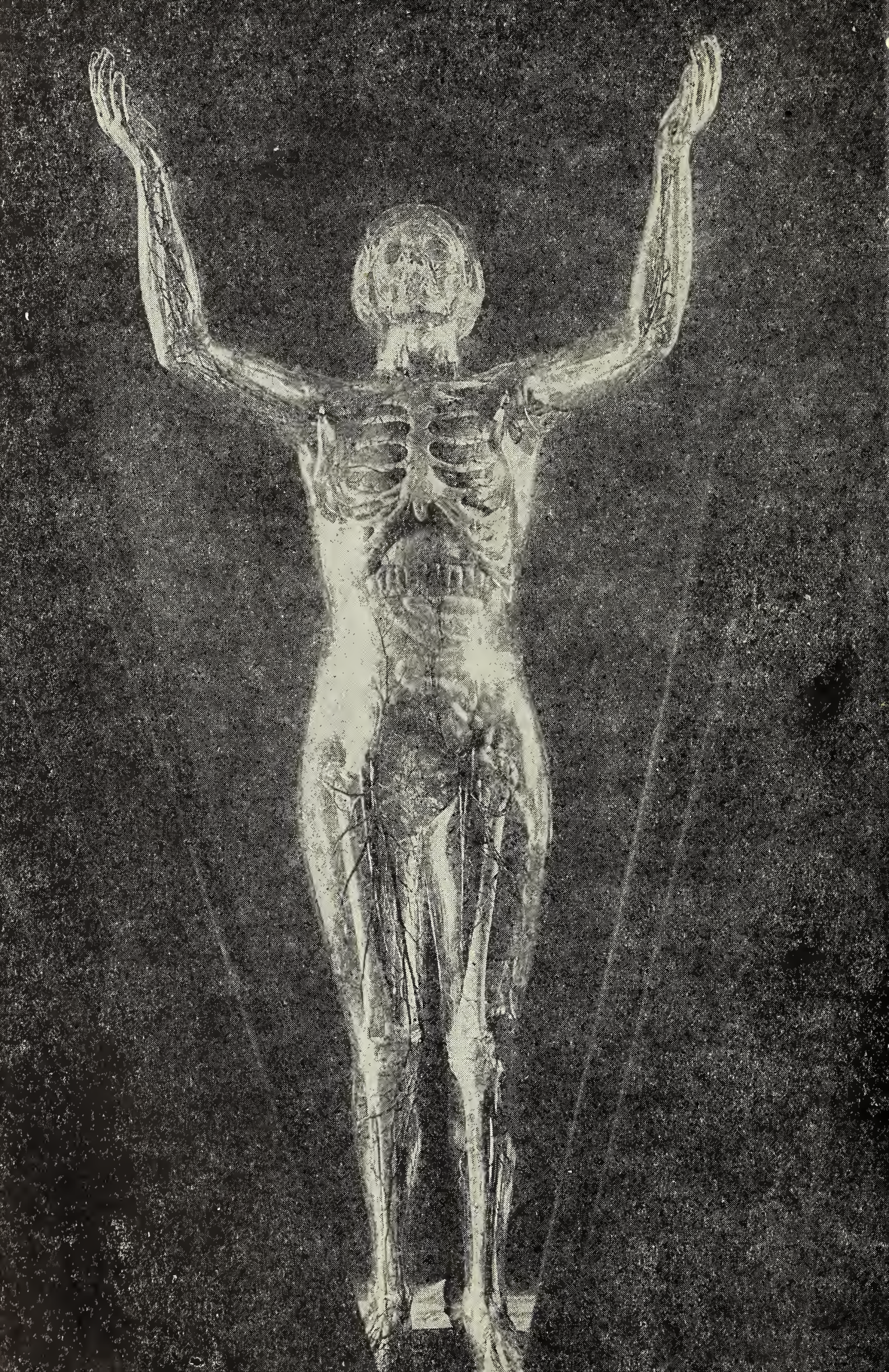


What superstition is?

Who Hippocrates was and why he is called the Father of Medicine?

In what way the human body may be compared to an automobile, and in what ways the human body is different from an automobile?

What your body means to you?



Hold out your right hand and look at it carefully. It is your hand. Think of all the things it does for you. Have you ever wondered why it can do the things it does? Put a finger on the thumb side of your right wrist about an inch from the base of your thumb. Do you feel the beat of your pulse? That steady beat is the pumping of your heart. Do you know what your heart does for you and how it does it? Look across the aisle at your neighbor and watch the rise and fall of his chest. Do you know why it rises and falls and what would happen if that motion stopped?

Anatomy is the name given to the science which tells how the body is built, and physiology is the name of the science which tells how the body works. In order to build these sciences many men and women in many generations spent their lives searching for information about the human body. The things you will learn in this book are known because these people have explored the body scientifically and can tell you how it is built and how it works. By using the knowledge they have won, you can learn how to take care of your body so that it will give you good service. Hygiene is the name given to the science which tells how to use the facts of anatomy and physiology in building the kind of body which will be a help instead of a handicap in working out plans for a long and happy and successful life.

Even after man became civilized, hundreds of years went by before much was known about the human body. So we say that anatomy and physiology are very young sciences. While modern anatomy celebrated its four-hundredth birthday in the year 1943, modern physiology was

The transparent man shows what the body would look like if we could see the inside as well as the outside

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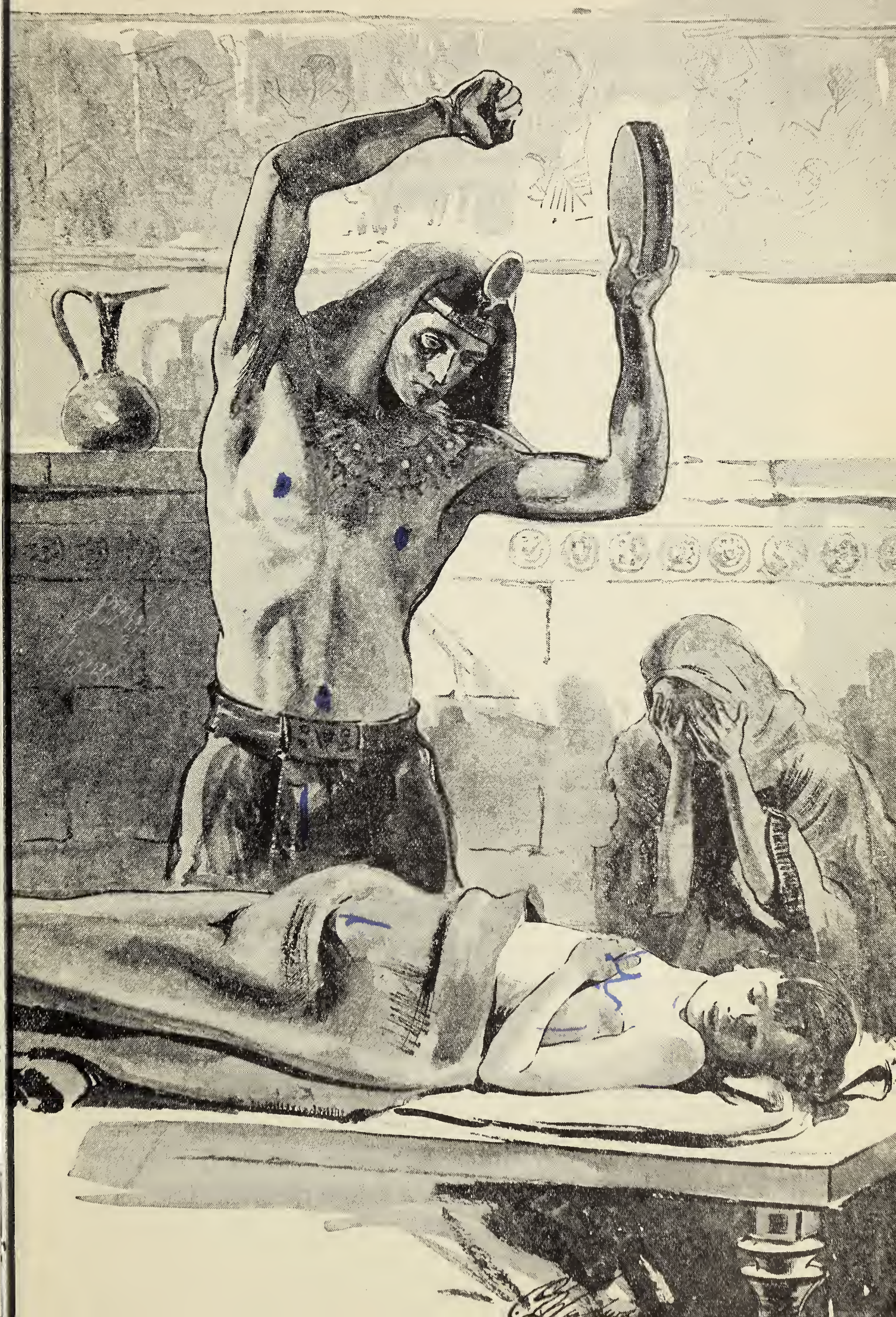
three hundred years old in the year 1928. How can we be so definite about these birthdays? Before we answer this question let us take a short journey into the past to find out what people knew about the body before these sciences were born.

In the Days of Magic

Let us imagine that we are visiting in the ancient land of Egypt. It is the season when the river Nile has fallen back between its banks after flooding the land. Over the grainfields lies a layer of rich black mud left by the falling waters. In a short time the mud dries beneath the blazing sun. A man and woman are walking over the fields in the cool of the evening. They are very sad. At home they have two little children who are very ill. The priest-physician can do nothing for them. He has told the father and mother that evil spirits have entered the children's bodies and are making them ill. He has beaten drums and uttered strange cries to drive away the spirits. He has tried to suck out the demons from between the children's lips. Now he has gone away. His magic has failed. Suddenly the woman catches her husband's arm. "Look!" she whispers. The man's eyes follow the woman's pointing finger. He sees three or four little mice crawling out of the cracks in the dried mud. The man and woman both think that the mice have been formed of the mud of Father Nile. They think that the mice must contain the life-giving powers of the great river which brings new strength each year to the grainfields.

Without a word to each other the man and woman start to catch the mice. When they have several, they hasten home. They skin the mice and give them to their sick children to eat. They think that the mice will fill their

Egyptian priest-physicians tried to drive sickness out of the body with magic charms and spells



children with the strength of Father Nile. They honestly believe that the mice will make their children well.

Back in the dawn of history, when the people in this story lived, very little was known about the human body. Life was supposed to dwell in the body as a person dwells in a house. In the form of a spirit it could leave and return to the body at will. In sleep the spirit might leave the body to go off hunting or to war. Waking from a dream was a coming home of the spirit. When an enemy struck a man with a club or wounded him with a spear, it often happened that the man's life left the body forever. Thus death came to be associated with injury. When people died of disease, it was thought that an evil spirit had gained possession of the body and had driven out its true owner. In treating disease, therefore, spells and horrible noises and other methods were used with the hope of scaring away the evil spirit.

People thought that in sickness the amount of life in the body grew smaller and weaker. And so substances which were supposed to be capable of adding new life and strength to the life already there were given as medicine. We have seen that mice were used in this way because they were supposed to be filled with the life and strength of the great Nile.

These people believed that they had perfectly good reasons for putting faith in their strange practices. They were doing the very best they could according to the beliefs of the times in which they lived. All they lacked was scientific knowledge.

In the light of the scientific knowledge we possess today, the charms and spells and other curious practices of primitive people have come to be known as magic and a belief in them as superstition. A superstition is a belief that is based on a wrong notion of how things happen. The very

word *science* means "knowledge." By observation and experiment the men of science try to find out the truth about the things that happen in the world of nature. Their discoveries help us to understand nature so that we can control it in a way that the magician never could with all his charms and spells.

The Birth of Science

Now let us jump ahead some thirty-six centuries to the ancient city of Athens in the land of Greece. Athens is at the height of her power. Poets, artists, great teachers, statesmen, athletes, are making an age so glorious that it will be known forever after as the Golden Age of Greece. But just now the streets of the city are almost empty. The sound of wailing is heard. Carts heaped with dead bodies crowd one another in the narrow muddy alleys. On one street corner stands a grave old man with a long white beard. His kindly face is filled with sadness. Out of the air, borne, as he thinks, on the wings of the wind, a horrible sickness called the plague has come to his beloved city. In his hand he holds a pan on a long stick. Smoke and a sharp sweet smell issue from the pan. The man is Hippocrates, the Father of Medicine, and he is burning spices to drive away the plague.

Not for another twenty-three centuries were men to know what causes plague and how it is spread from the sick to the well. But Hippocrates knew that it was not caused by evil spirits which could be driven out by charms and spells. He knew that it had a natural cause, even though he could not find it. Hippocrates and his students observed the human body itself for an understanding of the body in sickness and in health. Although they made few actual discoveries, they brought to the world the spirit of

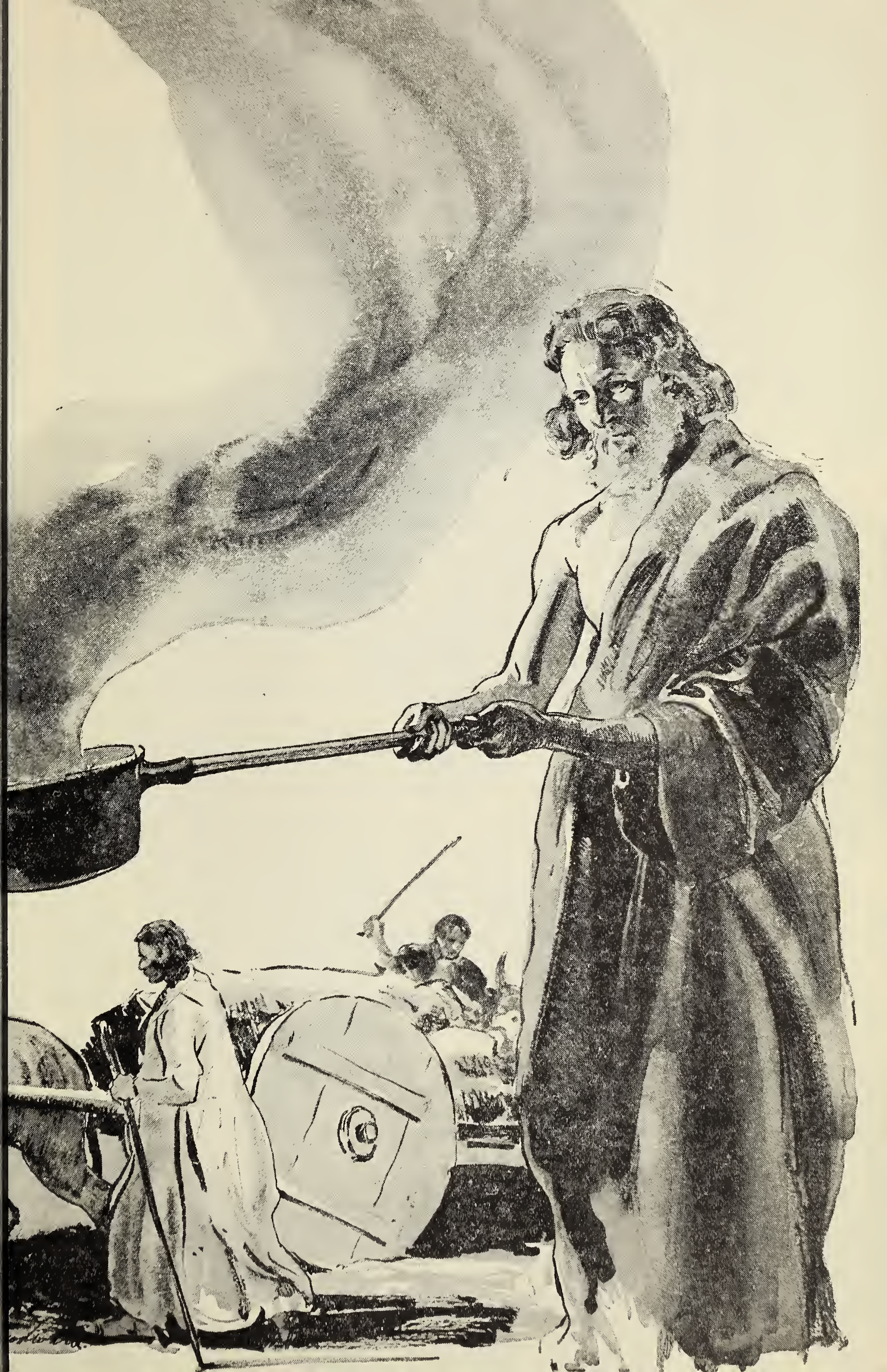
science, the desire to know. It is this spirit which has won for us the knowledge we possess today about the human body.

Science in the Roman Empire

From Greece we now travel to the city of Rome. It is the year 165 A.D., and Rome is a mighty empire. Along the street hustles a very busy physician on his way from patient to patient. He visits the poor in the city tenements and the emperor himself in his fine palace. The physician's name is Galen. He is a fine scientist as well as a good physician. He possesses the desire to know which has been passed on to him through many hands from the Golden Age of Greece. The examination after death of the human body is forbidden, but Galen is so eager to learn about its structure and how it works that he examines the bodies of animals. From what he sees and from the ideas of Hippocrates and other men he is working out explanations for almost everything that goes on in the body.

We know now that some of his explanations were right, but many of them were wrong. Galen never saw the inside of a human body. He lacked necessary instruments. He did not know how to make exact experiments. And yet all his ideas about the way in which the body is built and how it works—true and false all mixed up together—he wrote down in books. These seventy-eight books about the human body, about disease, about medicines, all written by one man, all full of mistakes, were fated to become school textbooks to be studied by medical students for fifteen hundred years! With such books as a guide little progress could be made in the science of health.

Hippocrates burning spices in the streets of Athens to drive away the plague. He knew that the plague had a natural cause, but he could not find it



After Galen's death, in about 200 A.D., more than thirteen centuries went by before a boy was born who corrected many of the wrong ideas people then had about the human body and paved the way for much of what we have since learned to be true. The book he wrote about the body was published in the year 1543. This is why we said that in the year 1943 the science of anatomy was four hundred years old. The name of this boy was Vesalius.

Vesalius had studied medicine from the time he was a lad, but he had been taught only from the books of Hippocrates and Galen. Once in a great while he was present when a dead body was dissected, or taken apart. But the dissecting was done by barber servants who merely separated the organs from the body and held them up for the students to see, while a professor sitting on a high seat read about them from a book by Galen. No one looked closely enough to discover whether or not what the book said was true.

Vesalius was not satisfied with this. He wanted to see and to handle for himself all the parts of the human body and find out how they are made. At last he had a chance to do this. He was made professor of anatomy in a great medical university in Italy when he was twenty-four years old. For five years he worked with his students, tracing out every muscle and nerve, examining every organ. All the things he had seen with his own keen eyes and felt with his own fingers were set down for other people to see and read about in a book full of beautiful exact drawings of every part of the body. This was a great step forward.

Vesalius made people acquainted for the first time in history with the general

"How exciting it must have been to be a pupil of Vesalius in the days when the modern science of anatomy was born!"

structure of the body, that is, the way in which it is built. But he did something even more important than this. He brought back to the world the spirit of science which had been born almost two thousand years before his day, in the Golden Age of Greece. To his curiosity, to his impatience with mere book knowledge we owe the first scientific exploration of the human body.

When Vesalius published his book about the human body, many of the great physicians of his day thundered against him. They said he could not possibly be right, because if he were right Galen must be wrong, and to them that was impossible. These criticisms made Vesalius very angry and sad. He burned all the notes he had made for other books. Before he was thirty years old, he had laid down forever the work he had so gloriously begun.

But Vesalius had shown the way. Following swiftly in his footsteps, his students and other scientists began the long hard task of exploring every nook and corner of the human body. Never again was it said, "This is true because Galen said so." Even those who loved and admired Vesalius never said, "This is true because Vesalius said so." They proved by an examination of the body itself that what Vesalius said was right or wrong.

The first scientific explorer of the body did not by any means find out all there is to know. Even today, with all the marvelous means for exploring the body which scientists possess, we do not know all that there is to know about it. But we know how to go about finding out the things we do not know. This way is the way of science, as it goes through the world outside us and the world inside us, testing and sifting what it observes until at last it is able to say, "This is true; I have proved it."

AN INTRODUCTION TO THE HUMAN BODY

A living body has often been compared to a machine. But the living mechanism does a great many more things than a machine, which is not alive. Even if we could imagine an automobile capable of going about and doing things all by itself, knowing when its gas tank is empty and stopping at a garage of its own accord to be filled up, filling its own radiator, blowing up its own tires, greasing its own insides, making its own repairs, we cannot possibly imagine a little automobile growing up into a big automobile. And yet the human body has the power to grow. It informs its owner of hunger and thirst and injury and fatigue. It oils its own joints, so that we seldom hear a body creak. It does its own repair work and maintains its own automatic heating plant. It has a transportation system for carrying supplies to the body cells, a communication system for carrying messages to and from the brain, and a sewer system for getting rid of body wastes. It has a wonderful system of defence to protect it from harm.

We are not conscious of everything that goes on inside us, and yet we are responsible for the body's ability to perform its work. We must give the body the raw materials out of which it weaves and mends its own strong beautiful fabric; we must supply the fuel food which gives the body the power to move and grow and keep warm; we must defend it against all the forces which have power to harm it.

The Fabric of the Body

Just by looking at the body from the outside we notice that it has several distinct parts: head, neck, arms, trunk, and legs. These big main parts are made up of smaller parts. In the head, for example, we see ears, eyes, nose,

and mouth. The arm is divided into the upper arm, elbow, forearm, hand, and fingers. Still by outside examination we can see that different parts of the body are made of different materials; the skin, eyeballs, lips, hair, fingernails, and teeth, for example, are not all alike. By touching different parts of the body we find out that it is partly soft and partly hard. When we cut a finger, blood oozes out; when we cry, tears flow down our cheeks. So we know that the body is also partly liquid. All this we learn simply by observing the body from the outside.

But although the body even from the outside appears to be an elaborate structure, we usually think of it as one unit. The skin, for example, seems to be all in one piece, with eye, nose, and mouth holes, like a costume worn at a Halloween masquerade. But this covering of the human body and the flesh and bones and blood beneath are not what they appear to be to the naked eye. If we could look at a very thin layer of flesh under a powerful microscope, we should see many tiny bodies called cells. Each one of these cells is alive, and each one can do many of the things that the body as a whole can do—breathe, eat, digest food, get rid of waste, and grow. The human body is a community composed of billions of such cells. Human beings share this cell structure with all plants and animals.

A cake of yeast, used to make bread rise, is a collection of cells, just as we are. But we are very different from a cake of yeast. Why is this? Each one of the cells in a yeast cake is exactly the same kind of cell. Each one works all by itself, completely independent of its neighbors. In the human body there are different kinds of cells which work together in groups to do special kinds of work. All these groups need each other in working together for the good of the whole body. So

"Just by looking into a mirror, we can see that the body has a number of distinct parts."

Steven A. Coons

we see that the body is not a single individual unit but rather a community in which groups of cell workers, each with a special job to do, work together for the common good. This good is the beautiful order in the human body which we call health.

Varieties of Cells and Tissues

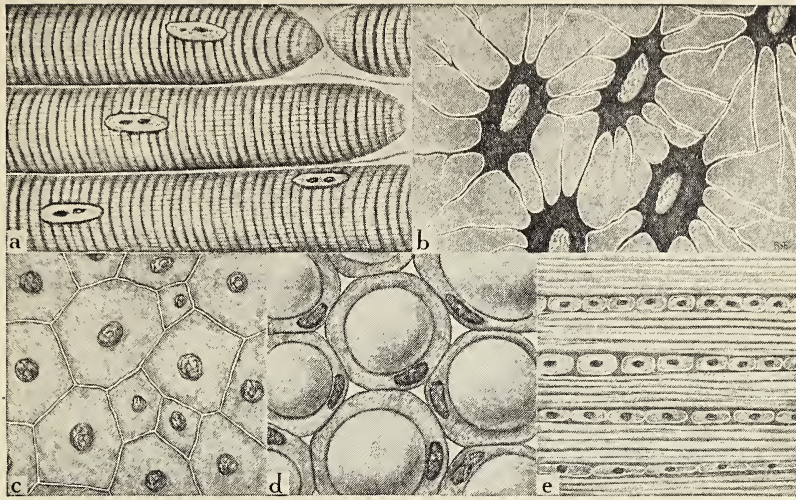
A young Frenchman named Bichat at the close of the eighteenth century examined with his microscope the structure of the animal body. He said that it looked like woven fabric and so he gave it the name *tissue*, which means "something woven." He found that different tissues in different parts of the body, such as bones, muscles, and nerves, have different patterns. The reason this is so is that each tissue is a group of cells with special work to do, and therefore the cells composing it are different from all other cells which do not do the same kind of work. There are seven different kinds of tissue in the body.

Bone tissue is very hard and dense, as we know simply from looking at and feeling steak or chicken bones. Bones form the skeleton, or framework, of the body.

Muscular tissue is made up of cells which are long and slender and which have the power to bunch up into short thick cells. Because of their long threadlike shape they are called fibers. All the physical work of the body is done by the muscles.

Glandular tissue is made up of cells which act like little factories in producing different secretions, or liquids, such as saliva, sweat, and the digestive juices. The milk you drank for breakfast this morning was produced by the glandular cells of a cow.

Epithelial tissue is made up of cells set very closely together to form a continuous protective coating. The skin,



This is what we should see if we could examine various kinds of body tissue under a high-powered microscope: *a*, muscle fibers; *b*, bone cells; *c*, flat epithelial cells; *d*, fat cells; *e*, connective tissue (tendon) cells

which covers the outside of the body, and the lining of the nose, throat, windpipe, stomach, and small and large intestines are composed of epithelial tissue. Cells of this tissue which have been transformed into a hornlike material form the hair, the fingernails, and the toenails.

Nervous tissue is made up of nerve cells from which fibers reach out like the tiny roots of a plant to touch the fibers of other nerve cells or the cells of other tissues. Nerve cells are linked together in living chains in order to carry messages to and from the brain and spinal cord, which also are composed of nervous tissue.

Each one of the cells which make up fatty tissue is a tiny thin-walled bag filled with a drop of fat. When the body does not get enough food to supply it with all the energy it needs, it can draw on the fat stored in these bags. This is why a fat person loses weight when he eats less

than he usually does. A large part of the fat in the body lies just under the skin and helps to keep the heat of the body from escaping too rapidly.

Connective tissue binds, or cements together, all the structures in the body and gives strength and firmness to the other tissues. Without it the different parts of the body would be disconnected. The tendons, or strong bands, which connect the muscles with the bones are made up of connective tissue.

The Body as a Whole

We have seen that each kind of tissue is capable of performing a certain kind of work. We also know that the body is in need of many different kinds of service. These services, or functions, cannot be performed by tissues working alone. And so certain tissues are combined with other tissues to form organs. Each organ performs a certain function for the body. For example, the stomach plays an important part in making food ready for the body to use. The heart, the lungs, the liver, and the kidneys are some of the other organs of the body. But none of these organs can work independently. Can you imagine what would happen if the stomach never received any food to digest, or if the digested food never left the stomach? The mouth and teeth, the stomach, the small intestine, and various glands must all work together to change food into the form in which it can be used by the body. Several organs linked together to perform some particular function form what is called a system. All the work of the body is divided up among the systems, such as the digestive system, the nervous system, the respiratory system, and the circulatory system. Each system performs a function which is essential to life and growth.

We have traced the structure of the body upward from cell, to tissue, to organ, to system. Knit together under one skin, into a perfect whole, is the wonderful living fabric which we call the human body. From the tiniest cell to the most elaborate system, all work together for the good of the whole body. Each part attends strictly to its own business and in doing so plays its part in helping to guard the wonderful gift of life.

TRY THESE TESTS

1. On a separate sheet of paper arrange the historical periods in the first column in their correct order and under each one write the groups of words or names from the second column which are related to that period.

the Golden Age of Greece	Galen
Egypt in prehistoric times	Vesalius
sixteenth century A.D.	Hippocrates
the Roman Empire	primitive peoples
	the birth of science
	the days of magic
	the writing of textbooks which were studied for fifteen hundred years
	the first scientific exploration of the body

2. Complete the following sentences by supplying the missng words. (*Do not write in the book.*)

a. The sciences which tell us how the body is made and how it works are --?-- and --?--.

b. The tissues of the human body are groups of --?--.

c. The hardest tissue in the body is --?--.

d. Saliva is produced by --?-- tissue.

e. The skin is made up of --?-- tissue.

f. The brain and spinal cord are composed of --?-- tissue.

g. --?-- tissue binds together all the other tissues of the body.

h. Different tissues bound together to do a special job in the body are called --?--.

i. All the work of the body is divided up among groups of --?-- linked together to form --?--.

THINK ABOUT THESE QUESTIONS

1. Do you think that exploring the body is as important as exploring the outside world? What are the reasons for your answer? What have you learned about the sciences of physiology and anatomy which leads you to believe that they will be good guides in a study of the body?

2. In what way may the body be compared to a community? Who are the individual citizens? What are the names of some of the working groups into which they are divided? What work does each of the groups named perform? What are some of the different organizations to which certain working groups belong in order to perform certain services in the body? What are some of the big special jobs in the body which require the co-operation of several organizations?

DO THESE THINGS

1. Make a list of superstitions in which some people continue to believe today. Perhaps a boy who had warts on his hands told you he got them from handling a toad. How do you suppose this superstition arose? How would you go about proving by experiment that handling a toad does not produce warts?

2. Form a Science Clipping Bureau in the class. This bureau may operate throughout the year. Clip stories from newspapers and bring in magazine articles which describe new discoveries or improvements connected with the advancement of knowledge of the human body. Talk over in class from time to time the reasons for the great advances made during the twentieth century in knowledge of the human body.

3. Draw an outline picture of your body and label the different parts. Locate on your picture the places where the heart and lungs are. How do you know they are there? Locate your stomach. What makes you think it is where you have placed it? Locate your brain. How do you know it is where you have placed it? Is there any way of knowing where the brain is by observing the body from the outside? Can we learn many things about the body by observing it from the outside?

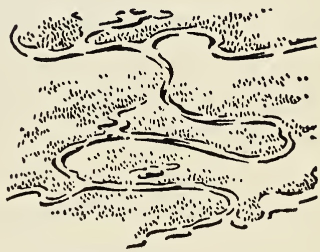
UNIT II

Transportation in the Body

The blood and the heart, which drives the blood through the body, seem to do their work without any help from us. During a ball game or a tennis match we do not tell the heart to beat faster, and yet it does so. Apparently the make-up of the blood and the rate of the heartbeat are maintained without any conscious direction on our part. How, then, can we help the heart and the blood in the performance of their duties?

DO YOU KNOW

Why the inside of the body may be compared to a swamp?



How the body cells get food and air?

Why you do not bleed to death from a small cut?

Why being cold sometimes makes us "catch a cold"?

What is meant by the circulation of the blood?

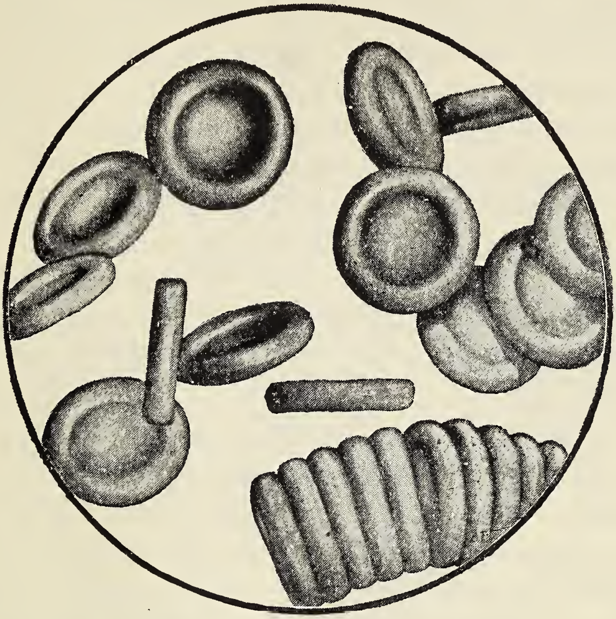
THE BLOOD AND ITS DUTIES

If someone should ask you to name the chief difference between yourself and a fish, you would probably say, "The fish lives in the water; I live on dry land." We think of ourselves as land dwellers, surrounded by air, rather than as water inhabitants. And yet all the billions of cells which compose the living body exist in a watery marsh.

If you have ever looked out over a great swamp, you have probably noticed streams flowing through the stagnant, grass-clogged water of the swamp itself. It is like that inside the body. The blood, enclosed in an endless system of tubes called blood vessels, flows through a cell-clogged swamp of salty water called lymph. The lymph is a fluid from the blood which has leaked out into the body through the thin walls of the smallest blood vessels, called capillaries. Lymph moves much more slowly than blood. At various places it is collected into tubes called lymph vessels and is poured back into the blood stream.

Water inhabitants get their food and oxygen from the water, and the water carries away their waste. The cells of the body also get their food and oxygen from flowing water, and their wastes are removed by the water which bathes them. The blood is the carrier of food and oxygen and waste, but it does not come in direct contact with the tissue cells which lie outside the blood vessels. The food and oxygen pass through the thin walls of the capillaries into the lymph, with which the cells are bathed. The cells soak up this food and oxygen through their thin walls and empty their waste products into the lymph. The waste collected by the lymph is poured into the blood stream, and the blood carries it to the special organs which have the power to remove wastes from the body. These organs are the lungs and the kidneys.

The drop of blood we see with the naked eye when we prick a finger is red in color. When we examine this drop



Red corpuscles look like this when they are magnified to a size 2400 times bigger than they really are

under a microscope, we see tiny red cells floating around in a clear yellowish liquid. The cells which give the blood its color are called red corpuscles. The name of the yellowish fluid is plasma, or blood serum. In our examination of the drop of blood we find also many white corpuscles moving about in the plasma under their own power.

The Duties of the Red Corpuscles

The total number of red corpuscles in the blood stream is immense. If they could be spread out over a flat surface, they would cover about four fifths of an acre. In

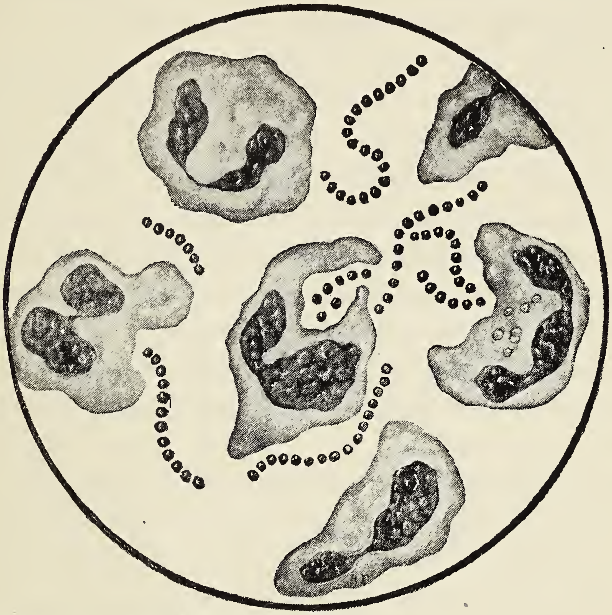
shape they are round and thin, like a coin, and slightly dented in the centre. They consist of a spongy red material called hemoglobin, a compound of iron. When exposed to air, hemoglobin absorbs oxygen. Hemoglobin gives the red corpuscles the power to take in a supply of oxygen from the air which enters the lungs when we breathe in, or inhale, and unload it in other parts of the body which need it. On the return trip to the lungs the red corpuscles carry a load of carbon dioxide, one of the waste products of the cells. The carbon dioxide is unloaded in the lungs and leaves the body when we breathe out, or exhale.

Red corpuscles live very short lives. About one tenth of all the corpuscles in the body die every twenty-four hours. New ones to take their places are manufactured in the red marrow which is contained in the ends of the long bones. Where do the corpuscles go when they die? They are carried to the liver, and there the iron in their hemoglobin is withdrawn, to be used in forming new corpuscles. A little of the iron is lost, but this loss is made up by the iron in the food we eat. If we do not eat food containing iron, one form of a condition called anemia is set up in the body. Both to prevent and to cure this kind of anemia, it is necessary to eat plenty of foods which contain iron. Among the foods rich in iron are egg yolks, molasses, whole-grain breads and cereals, liver, lean meat, prunes, apricots, soybeans, and spinach.

There is another form of anemia which is much more serious than the common type caused by a lack of hemoglobin in the red cells. This form, which usually occurs in later life, is called pernicious anemia. It is caused by a breakdown of the body forces which work together to manufacture red corpuscles. The result is a dangerous decrease in the number of red cells in the blood. Until recently this disease was always fatal after two or three years of illness.

The White Corpuscles and Their Duties

The white corpuscles of the blood are not so numerous as the red ones. They have the power to change their



White corpuscles devouring germs.
Both the corpuscles and the germs are magnified 2500 times

shapes and to move slowly from place to place. Their chief job is to act as the scavengers of the body. They are like an army of soldiers always on duty. The signal which sends them into action is the attack on the body by harmful germs.

When harmful germs enter the body through a break in the skin, white corpuscles rush to the place of the injury. There a battle begins between the germs and the white corpuscles. The white corpuscles fight by devouring the germs. The thick white matter, or pus, which collects around a sliver or pours out of an infected cut is composed partly

of hundreds of white corpuscles killed on the field of battle in defence of the body. When the whole body is attacked by the germs of an infectious disease, such as pneumonia or measles or scarlet fever, the white corpuscles come to the aid of the body in even greater numbers.

The skin, especially when it is clean and healthy, keeps enemy germs out of the body. When you cut your finger or fall down and bruise your knees or make any other break in the skin, there is less chance of infection if the skin is clean. But it sometimes happens that harmful germs do get into a wound. Often the white corpuscles are able to keep the infection from spreading. But sometimes the germs are so numerous or so powerful that the white-corpuscle defenders cannot overcome them. In this case the germs or their poisons may enter the blood stream and make the whole body sick. This is what happens when blood-poisoning develops from an infected wound. Therefore cuts and scratches must be attended to promptly.

You can help the white corpuscles in their work of destroying germs in a wound by treating the wound immediately with an antiseptic, that is, a substance which has the power to stop or slow up the action of harmful germs. Iodine is one of the best known and most useful antiseptics. As it is a poison, it should be clearly labelled and stored in a place where little children cannot reach it.

Alcohol is a very good substance to use as an antiseptic in cleansing wounds. Many of the antiseptics which are on sale at drug counters contain it. But alcohol taken into the body by drinking alcoholic beverages hinders the white corpuscles in their task of fighting germ invaders. From the digestive system alcohol enters the blood stream, where it reduces the fighting strength of the body by weakening and sometimes destroying white corpuscles and also by lowering the body temperature.

The Plasma and Its Duties

The plasma of the blood, in which the red and white corpuscles float, is a watery mixture of salt, sugar, and materials composed mostly of albumin. If you had an egg for breakfast, you ate albumin, because the white of the egg is composed of this substance. The plasma carries food materials in liquid form from the small intestine to all parts of the body. Not one living cell out of all the billions in the body is allowed to starve to death. The plasma, with its precious freight, supplies them all with food according to their needs. Food materials which are not needed at the moment are carried by the plasma to places where they are stored for future use. The plasma also removes all the waste products of cell activity except carbon dioxide.

All other substances which must be carried from one place to another in the body also are found in the blood stream. Among the most important of these are secretions from certain glands and substances called antibodies which the body manufactures as a defense against certain diseases.

The tiniest hole in a pail full of water means that sooner or later all the water will leak out. Why do not all the blood and lymph leak out of our bodies when we cut or even prick a finger? The answer is found in a very remarkable power possessed by the blood plasma. To keep water from leaking out of the pail we patch the hole; the water has nothing to do with it. But in the human body the blood itself plugs a small hole in the skin. It does this by turning from a liquid into a jelly at the place of injury. When blood runs out over cut tissues, a substance is freed from tiny cells in the blood called platelets. This substance gives the blood plasma the power to form a clot.

How the Blood Helps to Control Body Temperature

The temperature of a healthy body rarely changes more than a degree. Think of that! Whether we stand at the north pole or the equator, whether we run shivering up a street in January or sit under a tree fanning ourselves and drinking cold lemonade in July, the temperature of the body stays at about 98.6 degrees Fahrenheit.

The burning of fuel food by the working muscles is what keeps the body warm. The body is always producing heat because certain muscles, such as the heart muscle and the breathing muscles, are always working. You can prove that muscle activity produces heat by running very fast or swinging your arms vigorously. To keep the temperature of the body always at the same level, heat must be allowed to escape when the muscles are especially active or when the surrounding air is very hot. On the other hand, heat must be kept from escaping when the air is cold.

On a hot day heat cannot pass easily from the body into the outer air. Then water in the form of sweat is poured out on the surface of the skin. The evaporation of this water cools the skin and also the blood flowing through the tiny blood vessels in the skin.

On a cold day all the little vessels near the surface of the skin contract, or shrink, so that the warm blood inside does not come in contact with the cold air. The small openings, called pores, through which sweat is poured out on the skin close as tightly as possible. All the heat-producing activities of the body are also speeded up.

If the circulatory system did not help to regulate the temperature of the body, we should be at the mercy of our environment instead of being able to control it. But the circulatory system needs help from us in its job of

regulating body heat. If the temperature of the air surrounding the body is below 80 degrees Fahrenheit, not enough heat is produced by the ordinary muscular activities of the body to balance the amount of heat lost from the body through the skin. Therefore we must give the body a "private climate" of its own. We give it this climate by wearing clothes. Clothing covers the skin and helps to keep too much heat from escaping.

Preventing Chilling of the Body

When the temperature of the body is lowered, its activities slow down. This is why getting chilled sometimes paves the way for "catching a cold." Germs which cause the cold are able to gain a foothold in the body because the protective forces of the body are weakened. When we go out of doors in cold weather, we need enough extra clothing to prevent too great a loss of body heat. It is also important to keep the clothes and shoes dry. In warm weather when garments are wet through, sweat cannot evaporate easily, and we feel hot and uncomfortable. In cold weather body heat is lost quickly through wet clothing, and the body becomes chilled.

You have learned that exercise increases the production of heat in the body. Brisk exercise on a cold day helps to keep you warm. But during hard exercise the body becomes bathed in sweat. When you stop exercising, this sweat evaporates very quickly. As a result the body is chilled unless you take steps to prevent it. In "cooling off" after hard exercise it is important to wrap up warmly until the sweat has evaporated or, if it is possible, to take a shower and a brisk rubdown and then put on dry clothing. It is important not to "stand around" and so risk becoming chilled.

HOW THE BLOOD CIRCULATES

The blood flows in an endless system of blood vessels from the heart and back to it. The heart is the pump which furnishes the power to drive the blood through miles of blood vessels. The great majority of these blood vessels are the tiny capillaries which wind in and out among the cells. The blood vessels through which the blood flows on the outward voyage from the heart are called arteries. The vessels through which the blood flows back to the heart are called veins.

The Heart and How It Works

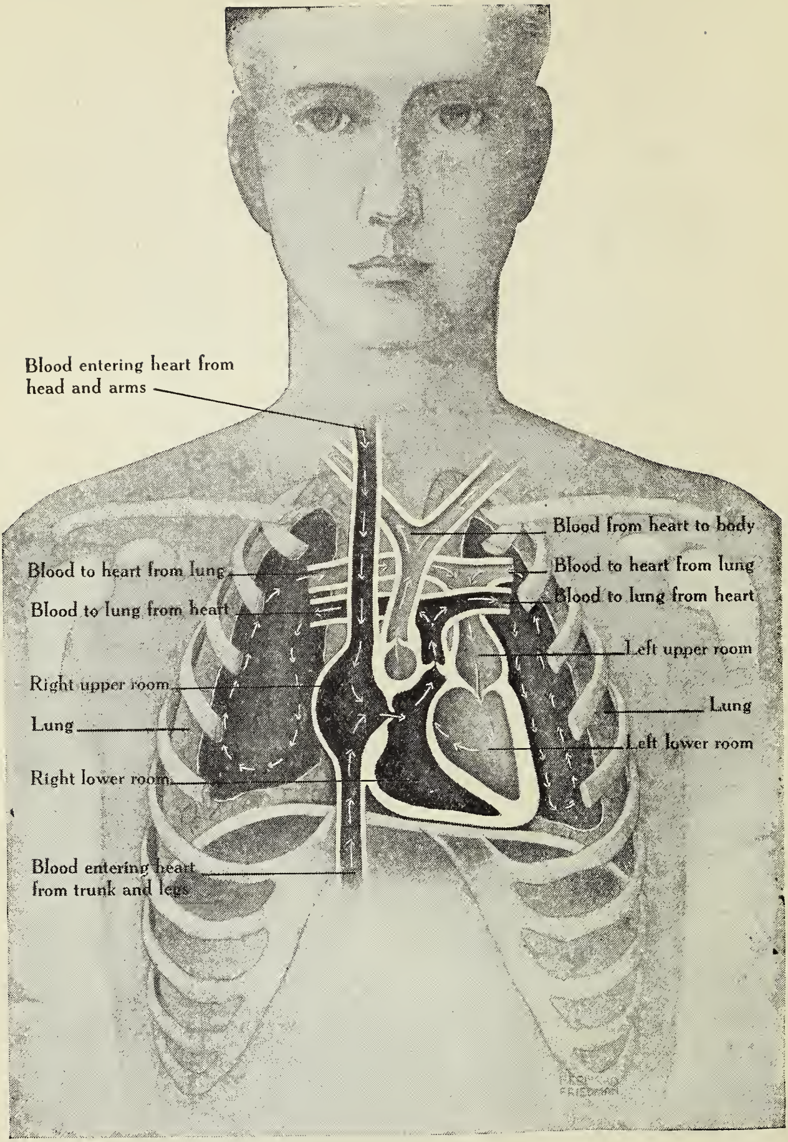
Blood makes up about one twentieth of the body weight. Accordingly a man weighing one hundred and sixty pounds has about eight pounds of blood. How much have you?

Since the blood is limited in amount, it must be used over and over again. The heart, which drives the blood on its endless round, is a powerful muscle divided into two main chambers, a right and a left. The dividing line between the two chambers is a blank wall. There is no communication of any kind between them. Therefore we may think of the heart as two pumps set side by side. The left side of the heart pumps the blood to all parts of the body except the lungs; the right side pumps it to the lungs only.

Each of the two main chambers of the heart is in turn divided into two rooms with a valve, or door, between. The upper rooms are the reception rooms; they receive the blood from the veins as it returns to the heart. The lower rooms are the pump rooms; they speed the blood on its outward journey through the arteries.

Why is this boy pulling on his sweater after making a home run on a windy day?

Steven A. Coons

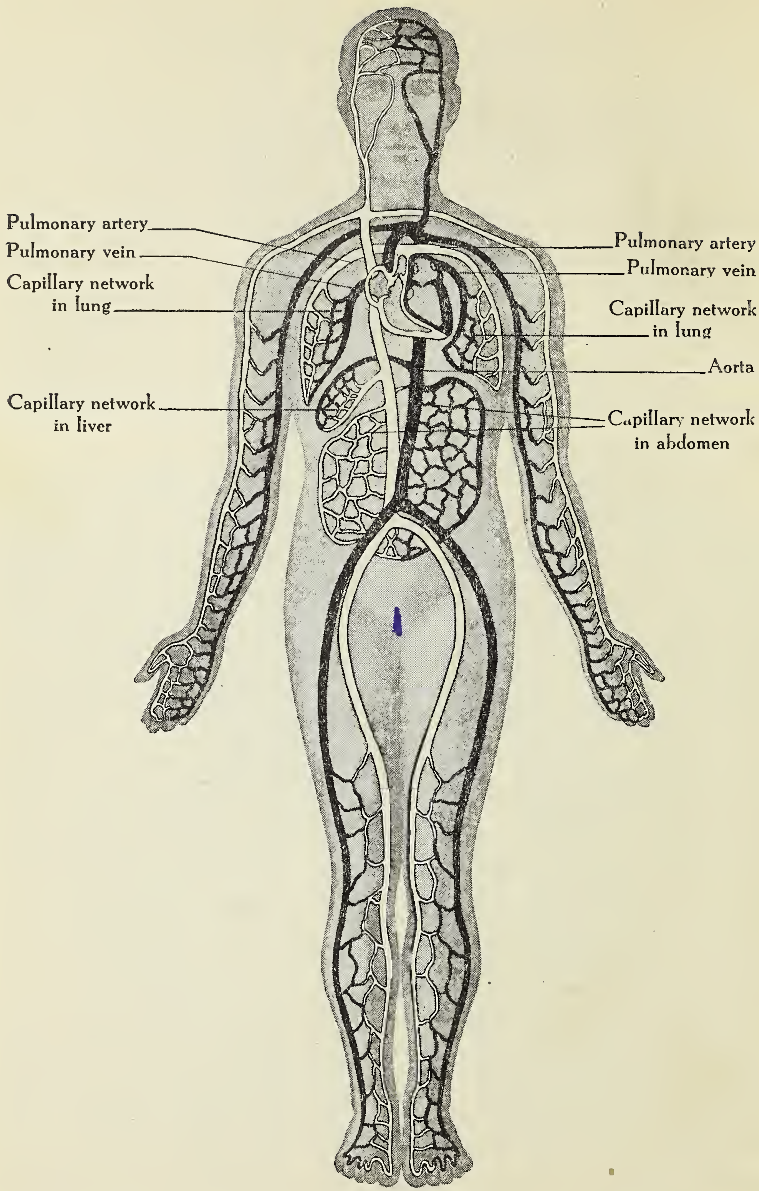


By following the arrows you may see
how the blood moves in a circle
from the body→to the right side of the heart→to the lungs→
to the left side of the heart→and out to the body again

The arteries which carry the blood away from the heart are often compared to a tree. The aorta, which opens out of the left lower room, is the trunk of the tree of arteries. Leading out from it are the main branch arteries, which run to the head, arms, legs, and the organs of the abdomen, or cavity below the chest. These branches in turn divide and again divide until the vessels become so small that we may compare them to the twigs of a tree. These tiny arteries penetrate to every region of the body, no matter how far away it may be from the heart.

The walls of the arteries, even the smallest of them, are too thick for anything to pass to and fro through them. And yet the whole purpose of the hard-working heart and the system of arteries and veins is to deliver food and air to the cells and to carry away their wastes. To accomplish this purpose the tiny arteries open into the still finer blood vessels called capillaries. The capillary walls are so thin that gases, such as oxygen and carbon dioxide, and dissolved food materials easily pass through them. The capillaries form a network of blood vessels much finer than the meshes of a spider's web. They wind in and out everywhere among the cells. You cannot prick any part of your skin with a fine needle without drawing blood. This blood comes from punctured capillaries.

When the blood enters the capillaries from the tiny arteries, it is bright red. After unloading food and oxygen into the lymph, which bathes the cells, and taking on in exchange a load of carbon dioxide and other wastes, it becomes bluish in color. From the fine mesh of capillaries this bluish blood flows on into the tiniest twigs of the tree of veins. Gradually the veins get larger and larger until at last they branch into the two trunks of the tree



In this diagram the arteries are black, and the veins white, with one exception. Why are the pulmonary arteries white and the pulmonary veins black?

of veins, which empty the bluish blood into the right upper room. From here the blood flows down into the right lower room, and at the next beat of the heart it is forced into an artery, which carries it to the lungs. As it passes through the network of capillaries in the lungs, the red corpuscles give up their load of carbon dioxide and take on a fresh supply of oxygen. The blood loses its blue color and becomes bright red again. It then returns through a system of veins to the left upper room, from which it is emptied into the room below. From there it again starts on its journey around the body. Trace this journey on the diagram.

TAKING CARE OF THE HEART

During vigorous exercise the heart thumps so hard and so rapidly that we can feel its throb all over the body. Why is this? Working muscles must have extra supplies of food and oxygen. They produce waste materials more rapidly than they do when they are not working. The blood is the carrier of everything that must be transported from one place to another in the body, and the heart is the pump that sends the blood on its rounds. The heart beats hard and fast when you are running, skating, rowing, or playing baseball or football or other athletic games, because the delivery of supplies to the working muscles and the removal of waste must be speeded up. This extra exercise is good for the heart because it helps to strengthen it, so that it is equal to the occasion when any sudden strain is put upon it.

The heart needs rest as well as exercise. The rest period between beats is almost twice as long as the beat itself. But the heart also needs the additional rest it gets when

a person is resting or sleeping. When a person is lying at rest, there are eight or ten fewer heartbeats a minute than when he is in an upright position. And yet the flow of blood at each beat is greater, as it is much easier to force a liquid through tubes which are lying flat than through tubes that are standing upright. If the heart saves ten beats per minute, it will save six hundred beats per hour. You can easily figure out how many beats the heart saves during an average night's rest in bed.

Excitement of any kind also makes the heart beat faster. This is because excitement is often followed by muscular action. When you are "fighting mad" or scared or joyful, the nervous system sends a message to the heart to beat faster because the muscles may soon be hard at work helping you to fight or to run away or to shout and jump up and down with joy.

Although exercise is good for the heart, overwork is bad for it. When a young person wishes to go into sports which call for violent or prolonged muscular effort, he should have a physician examine his heart. The physician will be able to determine the amount of work his heart is able to do and whether or not serious injury may result from any form of exercise which places great demands on it.

Alcohol increases the rate of the heartbeat, but the output of blood at each beat is smaller. This means that the heart has to work harder to produce the same results. Alcohol also may cause some of the cells of the heart muscle to change to fat. Fat cells are not working cells. In the busy heart they are like drones in a beehive. The working cells must not only speed the blood on its rounds but also lift a mass of fat at every beat. This heavy work may weaken the heart.

Infectious diseases or defective teeth may result in harmful germs being carried to the heart and so cause damage.

If a person has a heart defect, or weakness, it is a great piece of good fortune to have it discovered early in life. Then he can make plans for the sort of work in life which will enable him to give his heart the proper care and at the same time to lead a useful and happy life.

THE DISCOVERY OF THE CIRCULATION OF THE BLOOD

We can hear the heart beat. We can see the blue veins lying just under the surface of the skin of the underside of the wrist. We can feel the wave, or pulse, sent along the stream of blood in the arteries when the heart beats, by placing a finger on the wrist at the base of the thumb or on the temple just in front of the ear. But how do we know that the blood moves in a circle from the heart and back to it? Mankind has known this fact for only a little more than three hundred years.

In the year 1598 a twenty-year-old English medical student entered the same university in Italy where Vesalius had taught fifty-five years before. His name was William Harvey. As the eager black-eyed schoolboy listened respectfully to his teachers, little did they realize that his name would one day become famous. After completing his four-year course, Harvey returned to London as a doctor of medicine. He became physician to the unhappy king, Charles I, and was invited to lecture on anatomy at the College of Physicians.

In these lectures Harvey began to discuss the things he had discovered about the movements of the heart and blood long before he put his ideas into a book. This book was published in the year 1628. It is one of the most important books ever written. Harvey tells us how dis-

couraged he was when he began his task, how he thought then that "the motion of the heart was only to be understood by God." He describes the beautiful and exact experiments by which he proved at last that the blood does actually "move as it were in a circle" and that the whole purpose of the heart is to keep it in motion.

Harvey's new idea that the blood is "forever moving in a circle" was quickly accepted by the world of science. So many puzzling things about the workings of the body became clear in the light of this knowledge that the year 1628, in which Harvey's book was published, is called the birth year of the modern science of physiology.

Harvey was able to prove by experiment all the facts about the circulation of the blood except how the blood gets from the ends of the tiniest arteries into the ends of the tiniest veins. He thought that the blood from the

Dr. William Harvey explaining the circulation of the blood to King Charles

arteries escaped into empty spaces from which it was gathered up by the veins. It was left to another great scientist, the Italian Malpighi, to see for the first time that the whole system of blood vessels is never-ending. By calling to his aid the newly invented microscope, he saw in the dried lung of a frog the tiny winding tubes which we now call capillaries, and which join the endings of the tiny arteries to the beginnings of the tiny veins.

From the time that animals and men have lived on the earth the vital fluid that we now call blood has swept in closed vessels through all the tissues of the body. The cave boys and girls who pricked their skins on sharp thorns thousands of years ago saw the same kind of red blood that we see today when we cut a finger or have a nosebleed. To the young folks in the very dawn of history those drops of red were something to wonder at as a mysterious part of themselves. For us today blood is no longer a mystery, thanks to the many people in different times and countries who have explored the body for the bits of hard-earned knowledge which, put together, make the wonderful story of how air and food are carried to all the cells of the body.

ARE YOU DOING YOUR BEST TO HELP THE HEART AND BLOOD IN THE PERFORMANCE OF THEIR DUTIES?

Do you give your heart extra exercise by playing out of doors every day?

Do you give it extra rest by sleeping at least ten hours each night?

Do you go to the dentist regularly every six months for a checkup on your teeth?

Do you have a physical examination by a doctor at least once each year?

Do you cheerfully obey the doctor's orders when you are sick?

Do you keep your skin clean by washing it frequently with warm water and soap?

Do you always wash a cut or scratch with soap and water, apply iodine or some other antiseptic, and keep the wound covered with sterile gauze until it heals?

Do you eat each day foods which contain iron?

Do you wear clothing which suits the weather?

Do you wrap up warmly or rub yourself dry and put on dry clothes after you have been exercising vigorously?

1. Which of the following statements are true and which are false? Reword each false statement to make it true. (*Do not write in the book.*)

a. The heart pumps the blood through miles of blood vessels.
b. In many places these blood vessels come to an end.
c. The cells do not come directly in contact with the blood.
d. The blood plasma carries both food and wastes.
e. The lymph is part of the blood.
f. The liquid part of the blood is red.
g. The red corpuscles carry oxygen.
h. The white corpuscles help to protect us against infection.
i. The blood helps to control body temperature.
j. The temperature of the healthy human body is always about 98.6 degrees Fahrenheit.
k. Blood platelets give the blood plasma the power to leak through the capillaries into the lymph.
l. Malpighi discovered the circulation of the blood.

2. Select the best ending for each of the following statements. (*Do not write in the book.*)

a. Red corpuscles are made chiefly of · (1) hemoglobin · (2) albumin · (3) carbon dioxide.
b. Blood is carried away from the heart by · (1) the arteries (2) the veins · (3) the capillaries.
c. Blood flows back to the heart through · (1) the arteries · (2) the aorta · (3) the veins.
d. Harmful germs which enter the body are attacked by · (1) the red corpuscles · (2) the white corpuscles · (3) the plasma.
e. The place in the circulatory system where food and air are delivered to the cells is the · (1) heart · (2) capillary network (3) veins.
f. Blood changes from blue to red in the · (1) heart · (2) arteries (3) lungs.
g. If a person has a heart defect, it is best · (1) not to know anything about it · (2) to give up hope of a useful life · (3) to choose an occupation which will enable him to give his heart the proper care.
h. To prevent anemia we should · (1) take advertised medicines which are said to contain iron · (2) sleep with the windows open (3) eat plenty of foods which contain iron.

i. In choosing what clothes to wear each morning we should first consider whether they are · (1) stylish · (2) suited to the weather (3) new.

j. When we are wet with perspiration after hard exercise, we should (1) sit down and cool off quickly · (2) drink plenty of water (3) keep wrapped up until the sweat has evaporated.

THINK ABOUT THESE QUESTIONS

1. What are some important reasons for regular visits to the dentist and a yearly health examination?

2. A modern physiologist, Sir Michael Foster, says, "It may be truly said of Malpighi that whatever part of natural knowledge he touched he left his mark; he found paths crooked and he left them straight, he found darkness and he left light." Is not this a fine description of the mission of the scientist? Can you name other scientists whom the description fits? What are some of the reasons for your choice?

DO THESE THINGS

1. Get an empty gelatin capsule from your druggist. Ask for one an inch long. Fill one half with molasses or sirup. Fit the other half over it and drop it into a glass of water. At the end of fifteen or twenty minutes examine the capsule. What has happened? Does this help to explain how food (represented by the molasses) gets from the capillaries (represented by the capsule) into the lymph (represented by the water)?

2. If possible, examine a drop of blood under the microscope. Make a drawing of what you see.

3. Get a beef or pig heart from a butcher. With a sharp knife dissect it and find the "rooms."

4. Find out more about the life of William Harvey (1578–1657). Who was ruler of England during the early years of his life? What great writers and explorers were living then? Find out something about the life of the common people.

5. Harvey was one of the first scientists who used mathematics in exploring the human body. You can work out one of the

first problems which set him to thinking about the motion of the heart and blood. He figured out the amount of blood which the heart forces into the arteries at each contraction. This amount is five ounces, two and a half ounces into the pulmonary artery and two and a half ounces into the aorta. On an average the heart contracts seventy-five times a minute. How much blood does the heart pump in a minute? in an hour? in a day (of twenty-four hours)? Blood forms about one twentieth of the body weight. How much blood does your body contain? In what length of time does your heart pump as much blood as is contained in your whole body? Do you see why Harvey exclaimed, "Where does all this blood come from? Where does it go to —unless it circulates?"

After a painting by Dubois

René Théophile Hyacinthe Laënnec invented the instrument called the stethoscope, which a doctor uses in listening to the sounds made by the heart. Find out more about the instrument he invented

6. Compare the care of the wounded in some war before the twentieth century with that in the World War. Find out what is done in a modern hospital to prevent wound infection.

7. The rate of the heartbeat is determined by counting the number of beats per minute. This is usually done by placing a finger of the left hand on the pulse in the right wrist. Take your pulse at different times and during various activities. Using your record as a guide, what are some of the things we do which cause the heart to beat at different speeds?

UNIT III

How the Body Makes Use of Air

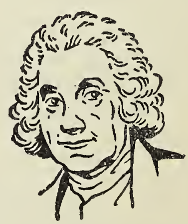
Have you ever opened the damper of a furnace or stove to let in fresh air when the fire is burning low? Unless fresh air is blown into the fire to take the place of the used air, the fire will go out. Fire in burning, and animals and human beings in breathing, take something from the air.

DO YOU KNOW

What this "something" is?

The difference between an in-breath, or inspiration, and an out-breath, or expiration?

What important discovery was made by Joseph Priestley?



What happens in breathing?

A good recipe for cold prevention?

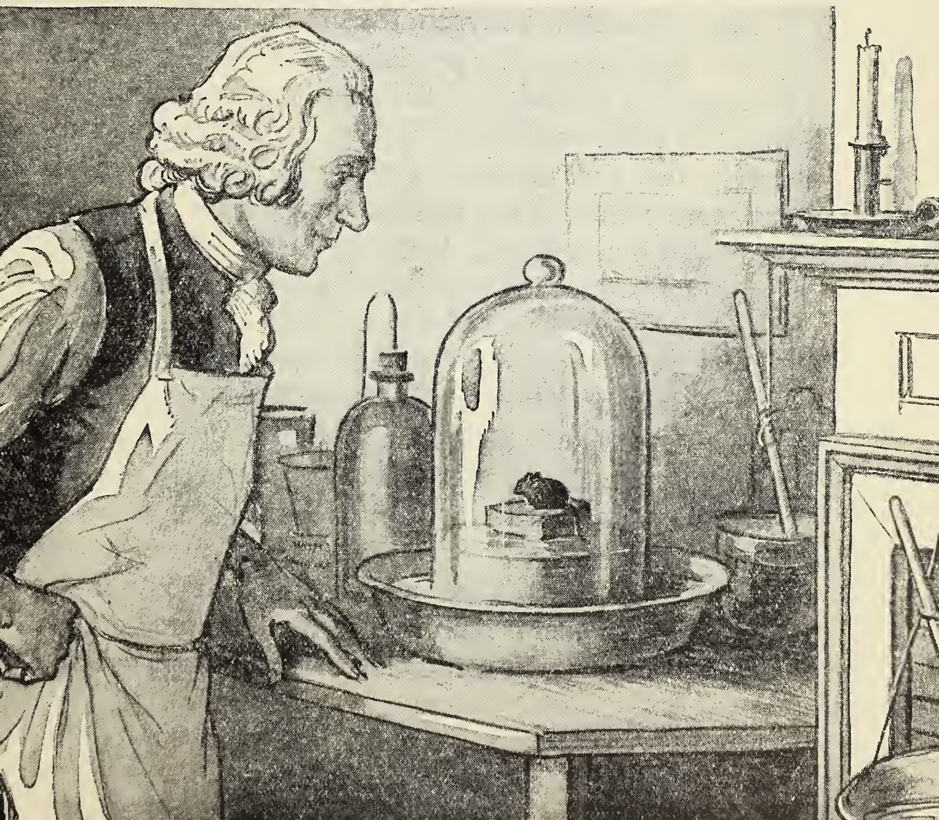
Which illness causes the greatest loss of time from school?

How you can provide good air for your home and schoolroom?

BREATHING AND BURNING

The use in the body of the substance called air was one of the hardest puzzles which scientists had to solve. It was easy to see that air is essential to life. The expression "the breath of life" was familiar to everyone. It was also easy to observe that air is drawn into and forced out of the body by the movements of the chest. But there remained the big unanswered question "Why do our lives depend on air?" No one knew, although many people made guesses. No one had even suspected the connection between breathing and burning.

Joseph Priestley experimenting with oxygen.
He discovered that a mouse when first placed in a jar of oxygen is even more lively than in ordinary air



Then in 1660 a British scientist named Robert Boyle made an important discovery. With his newly invented air pump he drew part of the air out of a vessel in which he had placed a burning candle and a mouse. The candle went out; the mouse died. This proved that burning and breathing are alike in that neither can take place without air.

Joseph Priestley, an English scientist who lived in the eighteenth century, was interested in finding out what kinds of gases were produced by the burning of different substances. His method was to heat a substance enclosed in a glass jar by focusing on it rays from the sun by means of a burning glass. He then studied the gas developed. One day in 1774 he obtained from a substance called mercuric oxide a quantity of "air" like no air he or any other man had ever found before. In this air a candle burst into splendid flame. A piece of red-hot iron sparkled in it. Mice flourished in it. It was oxygen, the breath of life, the part of the air which makes life possible for all living creatures.

But what do animals and fire do with the oxygen? To have a fire there must be something to burn. The substance in fuel that burns is carbon. A lump of coal is almost pure carbon. Coal and wood and other fuels were once part of living plants. With the help of energy from the sun, plants use carbon in building their bodies. When a plant body or any part of it is burned, oxygen from the air unites with the carbon, and the sunlight energy used by the plant in building its body is set free. In a fire this energy takes the form of heat and light.

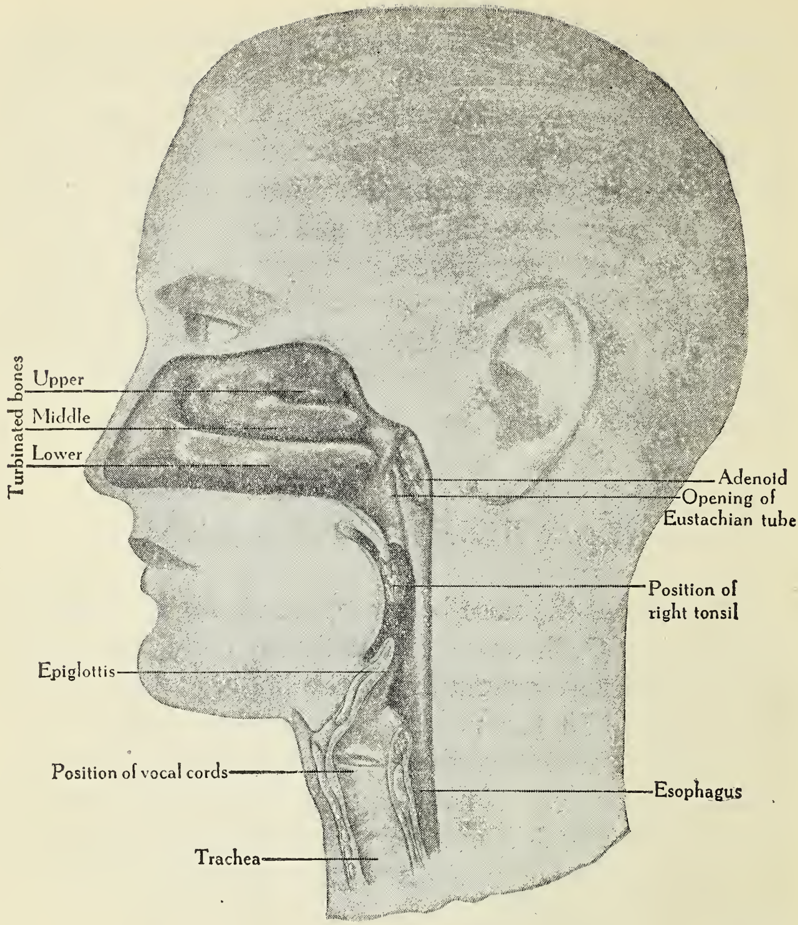
Respiration is the name of the whole scheme, or process, by which oxygen is delivered to all the cells in the body and carbon dioxide removed from them. We are well acquainted with part of this scheme, for breathing is the way in which oxygen is delivered to the lungs and carbon dioxide carried out. Air containing 21 per cent oxygen and

four hundredths of 1 per cent carbon dioxide enters the lungs on the in-breath, or inspiration. Air leaves the lungs on the out-breath, or expiration, containing 16 per cent oxygen and nearly $4\frac{1}{2}$ per cent carbon dioxide. We explain this by saying that an exchange of gases has taken place in the lungs between the blood and the air. Part of the oxygen has been exchanged for carbon dioxide. But this is only part of the whole process. The second part is the exchange of gases which takes place when the blood delivers oxygen to all the cells of the body and takes on a load of carbon dioxide in exchange.

THE AIR ROUTE TO THE LUNGS

The duty of the nose is to prepare air for its reception in the lungs. Ordinary air is usually dry and dusty, colder than the inside temperature of the body, and often contains germs. In the nose air is cleaned, warmed, and moistened. The nose is divided into two short narrow passages by a thin wall of soft bone. In order to increase the surface to which air is exposed in its short journey through the nose, three curved bones, called the turbinated bones, branch out into each passage.

These downward curving bones and all the rest of the nose passages are covered with a delicate layer of epithelial tissue called membrane. The membrane secretes, or pours out, a sticky, slightly antiseptic fluid called mucus. Therefore mucous membrane is the name given to this nose lining. The mucous membrane is well supplied with blood vessels close to the surface which act as radiators, or heaters, to warm the air. If the air breathed is too dry, the mucous membrane helps to moisten it. Particles of dust and germs are caught in the sticky mucus.



Use this diagram as a guide while reading
about the air route through the nose to the trachea

There is another way in which the nose filters, or sifts out, dust and other foreign particles in the air. Hairlike tissues called cilia cover the membrane lining of the nose. The cilia are always waving back and forth in the flowing air like grasses in a changing wind. Cilia are also found all the way along the air route, or passages, to the lungs. So

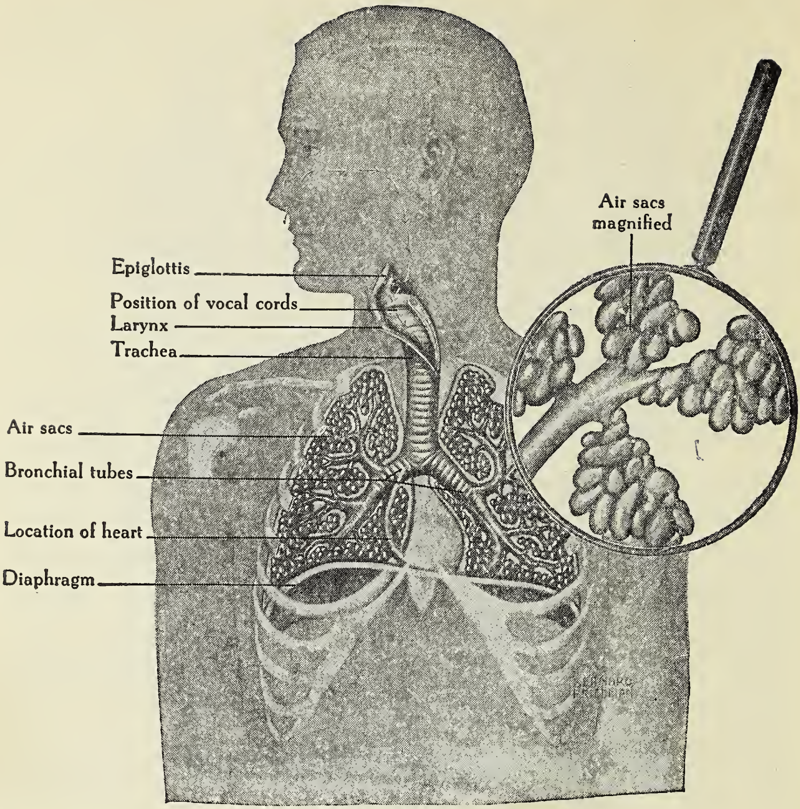
we see that the nose is well constructed to perform the duty of protecting the throat and lungs from cold, dryness, dust, and germs.

In the skull there are four pairs of small cavities, or air spaces, which open into the nose. These cavities are called sinuses. Small narrow passages connect them with the nose, and they are all lined with mucous membrane which is a continuation of that in the nose.

When a person has a severe head cold, the infection sometimes passes from the nose into one or more of the sinuses and causes an inflammation, or hot painful swelling. This inflammation is called sinusitis. It is more painful and serious than inflammation of the nasal passages. Swelling of the mucous membrane in a sinus may block the opening from the sinus cavity into the nose. Then pus, which often accompanies inflammation, cannot escape from the infected sinus, and the resulting pressure may cause severe pain. With the clearing up of the head cold the inflammation usually disappears; but if the pus is blocked up too long, it may cause a chronic, or long-continued, inflammation in the infected sinus. Then an operation must be performed by a surgeon in order to make an opening so that pus can drain, or flow out, freely.

Air passes from the back of the nose into the back of the throat, or pharynx. It is here that the tonsils are located. The passage called the Eustachian tube, which connects the throat with the ear, ends near the throat opening of the nose and close to the tonsils.

From the back of the throat the air flows down through an opening called the glottis into the windpipe, or trachea. Just behind the windpipe lies another tube, called the esophagus, down which food passes to the stomach. The glottis is fitted with a little lid, or cap, called the epiglottis. When food or water is swallowed, the lid closes and the



Use this diagram as a guide while reading
about the air route from the back of the throat to the lungs

food or water passes over the top into the esophagus. This is why food does not slide down the windpipe into the lungs instead of down the esophagus into the stomach. When you take a breath and swallow food at the same time, the lid lifts to let the air pass and food gets into the windpipe. People describe this accident by saying that the food "went down the wrong way." The food is driven out of the windpipe by powerful muscles that contract and cause coughing.

At the top of the windpipe is the larynx, or voice box. Its walls are formed of a tough flexible substance called cartilage. The vocal cords are two bands stretching across the larynx from front to back. When the voice is not in use, these are folded back against the side walls of the larynx. When you speak or sing, tiny muscles lift the bands away from the walls toward each other and into the current of air expelled from the lungs. The current of air makes the cords shake rapidly, or vibrate. The vibration produces the tones of the voice when you speak or sing. You can illustrate what happens by blowing on a blade of grass held tightly between your thumbs. The grass blade is shaken by your breath, and a sound is produced. The teeth, the tongue, and the fold of soft tissue hanging from the roof of the mouth at the back, called the soft palate, help to form the different sounds.

The windpipe divides into two branches when it reaches the lungs; one branch goes into the right lung, the other into the left. These branches are called the bronchial tubes. They divide and subdivide, as do the branches of a tree, until they become so small that we may compare them to twigs. Each tiny tube ends in an air sac, or bag, with very thin walls of elastic tissue.

WHAT HAPPENS IN BREATHING

The lungs are two big elastic bags divided into millions of air sacs. Each lung is fastened to the body at only one point. This is the place at the top of the chest cavity where the trachea branches into the bronchial tubes. The blood vessels also enter the lungs at this point. The airtight chest cavity, in which the lungs are enclosed, has movable walls and a movable floor. The floor is a thick

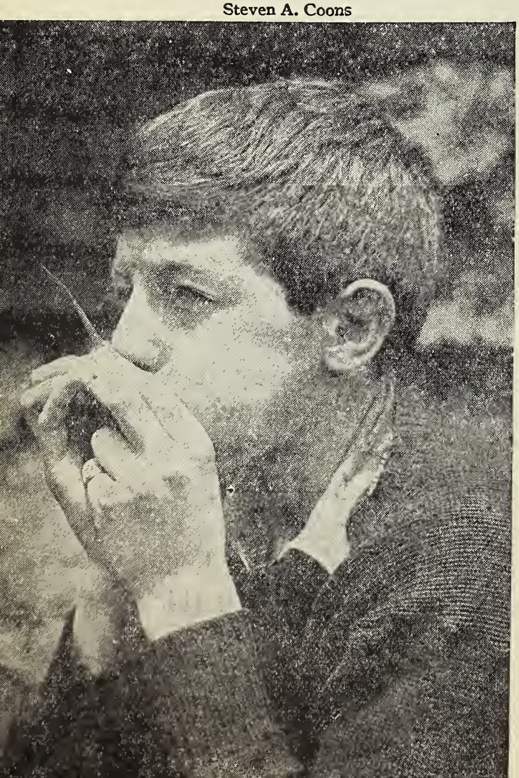
muscle called the diaphragm, which is fastened at its edges to the lower part of the chest walls.

Since the lungs are two elastic bags which take up most of the space in the closed cavity of the chest, you can easily see that any movement of the walls which makes the cavity larger or smaller will also increase or decrease the amount of air space in the lungs.

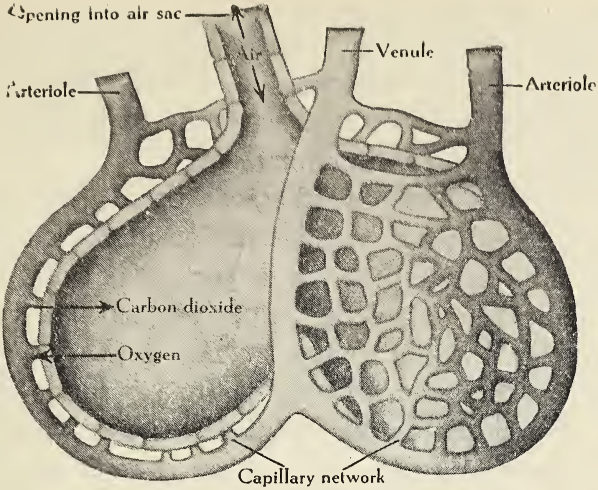
When you inhale, the diaphragm muscle is lowered to increase the height of the cavity, and the ribs are lifted to make it wider. Air, which has a pressure of about fifteen pounds to the square inch, rushes in and expands the lungs to fill this enlarged cavity. When you breathe out, the diaphragm is raised and the ribs are lowered to make the cavity smaller. Air is thus forced out of the lungs. The elastic walls of the air sacs also spring inward and help to drive out the air.

In the lungs the air and the blood meet, but they do not actually touch each other. A network of capillaries, much finer and smaller than the tiniest cobweb, lies in the walls of each air sac. Two walls separate the blood and the air: the walls of the air sacs and the walls of the capillaries. These walls are so thin, however, that oxygen and carbon dioxide can easily pass through them. The exchange of these gases in the lungs is one of the

Steven A. Coons



How is this boy illustrating what happens when he speaks or sings?



Air sacs highly magnified.
The front wall of the air sac at the left has been cut away
to show where the exchange of gases takes place

most interesting processes which go on in the body. To describe it we are going to compare it with the exchange of passengers which takes place when a train pulls into a station.

In the body the train, or carrier, is represented by the red corpuscles in the blood stream. The passengers are oxygen and carbon dioxide. The station platform is represented by the air sacs in the lungs. Red corpuscles crowded with carbon dioxide, which has been carried away from the cells of the body as a waste product, pass slowly through the capillaries in the walls of the air sacs. There is a great deal more carbon dioxide in the corpuscles than there is in the air sacs. Therefore the pressure of the carbon dioxide in the carrier is all in the direction of the station platform. So the carbon dioxide pushes out of the red corpuscles into the air sacs. However, it does

not leave unaided. In the air sacs the pressure is all the other way. There is a great deal more oxygen in the air sacs than there is in the corpuscles. Shoving and crowding the carbon dioxide out of its way, the oxygen seizes the vacant space in the carrier for itself.

This is what happens wherever these gases are exchanged in the body. At each station in the circulation, whether it be in the lungs or in the tissue cells, one gas hustles the other out of the corpuscles and holds its seat until it reaches a place where it also is hustled out. As blood passes through the lungs, the oxygen seizes the place left vacant by the carbon dioxide. As the blood passes through the tissue cells, the oxygen is removed and the carbon dioxide seizes the vacant place.

HELPING THE RESPIRATORY SYSTEM TO DO ITS WORK

All the advantage of the arrangements made in the nose for filtering, warming, and moistening the air is lost unless we breathe through it. Some people are in the habit of breathing through their mouths. The mouth is not fitted to warm or filter air. When cold dusty air is admitted directly to the throat and lungs, the possibility of colds and sore throat is increased.

Breathing through the mouth may be merely a bad habit, but often it is a sign that something is blocking the nose. If a person finds himself breathing through his mouth habitually, and the habit of nose breathing cannot be formed, the best plan is to get the advice of a physician.

The correct way to clean the nose of mucus is so important that in some schools boys and girls are trained to blow their noses with as much care as they are trained to read and write. The nose should never be blown with force.

Infected mucus may be forced up through the Eustachian tube, which leads to the ear, and start serious ear trouble.

The correct way to blow the nose is to cover the nostrils with a clean handkerchief. Leave both nostrils wide open. Blow gently in order to expel the mucus from the nostrils into the handkerchief.

A good habit to form is to carry a clean handkerchief every day. It is sometimes very embarrassing to be forced to use a soiled handkerchief in the presence of other people. The handkerchief should be carried in a place where it can be reached in time to cover a cough or sneeze.

Curing a Cold

In order to cure a cold it is necessary to help the body to fight it. Extra rest and plenty of liquids help the body in this fight. If possible, it is best to stay in bed or at least indoors. If the body temperature rises, that is, if fever develops, a physician should be called.

A person who has a cold must always remember that it is communicable, or "catching." The germs which cause it may be spread to well people in tiny droplets that spray out of the mouth into the air in talking, coughing, or sneezing. Cold germs may be present on eating utensils, towels, or anything else that a person with a cold has used or touched. In order not to give a cold to others the person who has one should always cover the mouth and nose with a handkerchief when sneezing or coughing.

It is very foolish to take medicine for a cold unless the doctor orders it. Cold tablets, cough sirups, and gargles advertised over the radio, in magazines and newspapers, on billboards, and in trains and busses may cause more harm than good. There is no sure cure for a cold. The very fact that so many remedies are advertised tells you

this. Some of the remedies sold for colds contain drugs that are bad for the heart or blood. Some of them contain habit-forming drugs. Sometimes depending on a medicine causes a person to neglect giving his body the sort of care which will help it to fight the cold.

The seventh-grade class of Parkside School never seemed to be free of boys and girls who had colds. At last a committee was formed to see what could be done about it. The committee went to the school doctor for suggestions. The doctor wrote out a prescription for the committee to take back to the class. It was not a prescription for curing colds but one for preventing them. This is the prescription:

1. Keep away from people who cough or sneeze carelessly.
2. Eat a variety of nourishing foods. (In each day's diet include a quart of milk; a green-leaf vegetable, such as spinach or beet greens, and a yellow-colored vegetable, such as carrots or yellow turnips; a raw green vegetable, such as lettuce or cabbage; an orange or grapefruit or tomatoes; and cod-liver oil.)
3. Always wash your hands with soap and warm water before eating or preparing food.
4. Drink at least six glasses of water a day.
5. Sleep ten or eleven hours each night.

We I wish Could

6. Work, play, and sleep in well-ventilated rooms.
7. Exercise outdoors every day.
8. Cool off gradually after exercise which makes you perspire.
9. Wear clothes that will keep you warm and dry out of doors in cold or stormy weather. Remove outdoor wraps when you come indoors.
10. Keep your feet warm and dry.
11. Breathe through your nose.
12. If any boy or girl keeps on having colds after giving this prescription a fair trial, a physician should be consulted.

Sometimes the air in an unventilated room becomes unfit to breathe. It used to be thought that this was caused by the decrease of oxygen and the increase of carbon dioxide. Later, scientists began to study the problem, and we now know that even in a closed room crowded with people it is almost impossible for the oxygen supply to become so low and the carbon dioxide content so high as to endanger life. However, experiment has also shown that an increase in both the temperature and humidity (or moisture in the air) in such a room makes the occupants extremely uncomfortable. The use of a fan to move the air helps to relieve the bad effects of high temperature and humidity.

The air in a room at high altitude is somewhat lighter or rarer than air in the same-sized room at sea level. In going from the seacoast to the mountains some difference may be felt in breathing, but the body soon adjusts itself to the change in altitude. However, aviators who fly to great heights find it necessary to carry tanks of oxygen.

How to Provide Good Air

We are most comfortable in a room in which the temperature is about 68 degrees Fahrenheit and in which the air is in motion. In the winter, when rooms are artificially heated, the air usually becomes too dry. Then the air may be moistened by placing a pan of water on the radiator or stove. In many schools the heating and ventilating systems are combined. A system of this kind, which performs the whole job of keeping the air of a building warm, moist, clean, and in motion, is called an air-conditioning system. In schools which do not have air-conditioning systems, and in most homes, window ventilation is used to provide fresh, moving, moist air. Windows should be raised from

the bottom and lowered from the top in order to secure air movement. A window board may be used to keep drafts of cold air from blowing directly on the people in the room. Many boys and girls have made window boards for their homes and schoolrooms.

A thermometer is a valuable aid in keeping a check on room temperature. Usually a thermometer placed on the inner wall of the hall or living-room will give the average temperature of a home. The thermometer should be consulted frequently, and when it reads above 68 degrees Fahrenheit, the furnace or stove should be checked or a window opened from the top and at the bottom.

It is also important to have the air of rooms as free from dust as possible. Dust in the air irritates the breathing passages. If one of your duties at home is to dust the furniture, use a damp cloth. In many schools dustless cleaning methods are now in use.

Outdoor air is the best air of all. It can move in every direction without being stopped by walls and floor and ceiling. Usually it is moist enough for health and comfort. Out of doors, too, we get the full benefit of sunlight. The boys and girls who spend as much time as possible out of doors in all seasons are the ones who are likely to be happy and wholesome and healthy. It is well to remember, however, that houses were invented to protect people from the cold and wet. When you go outdoors on cold or stormy days, you leave this protection behind, and so you must wear the kind of clothes that will keep you warm and dry. People who do not wear enough clothes to be comfortable outdoors in cold weather force their bodies to use up a great deal of energy unnecessarily in trying to keep warm. If outdoor wraps are worn indoors, the body is forced to perspire to get rid of heat.

hich one of the requirements
f good ventilation is provided
for by opening a window from
both the top and the bottom?

ARE YOU DOING YOUR BEST
TO HELP THE RESPIRATORY SYSTEM IN ITS WORK?

Does your school physician or your family physician say you have a healthy nose and throat?

Do you breathe always through your nose?

Do you blow your nose in the correct manner?

Do you try to avoid catching cold by following the prescription for preventing colds given on page 62?

Do you stay in bed when you have a cold with a fever?

Do you let fresh air into your bedroom at night?

Do you refrain from taking advertised cold medicines?

Are you doing your best to protect other people when you have a cold?

TRY THESE TESTS

1. Which of the following statements are true and which are false? Reword each false statement to make it true. (*Do not write in the book.*)

a. Oxygen was first prepared by Priestley.
b. The mouth prepares the air for the throat and lungs.
c. The nose filters the air.
d. The sinuses are cavities in the lungs.
e. The epiglottis closes over the entrance to the windpipe when we swallow.
f. The trachea is a food pipe.

g. The exchange of oxygen and carbon dioxide in the body takes place in the lungs only.

h. The red corpuscles are the food-carriers of the blood.

i. The breathing in of air is inspiration.

j. The tonsils are of no use to the body.

k. Rest is the best "medicine" for a cold.

2. Complete the following sentences by supplying the missing words. (*Do not write in the book.*)

a. The air leaves the lungs on the out-breath containing less --?-- and more --?-- --?--.

b. When oxygen unites with carbon, --?-- --?-- is produced.

c. The inside of the nose is lined with --?-- --?--.

d. The voice box is situated at the top of the --?--.

e. The cavity of the chest is closed at the bottom by a muscle called the --?--.

f. The mouth and nose should be covered with a --?-- when we cough or sneeze.

g. We should always breathe through the --?--.

h. The --?--, the --?--, and the --?-- of the air of a room make the difference between good air and bad air.

THINK ABOUT THESE QUESTIONS

Priestley discovered oxygen, but the French scientist Antoine Lavoisier explained the part played by oxygen in respiration. Both Priestley and Lavoisier were ill rewarded for their great services as explorers in the field of science. Because of his political views Priestley had to flee from his home in England to America, where he died in 1804 in the state of Pennsylvania. Lavoisier was beheaded in France in 1794 by the leaders of the French Revolution. Sir Michael Foster, the English physiologist, said of Lavoisier's death: " . . . there passed away from this world, in his fifty-first year, this mastermind of science, who had done so much to draw aside from truth the veil of man's ignorance and wrong thought, and there passed away too the hope of his drawing aside yet other folds of that veil, folds which perhaps wrap us round even to-day." Can you explain what Sir Michael Foster meant by this statement?

Do you know the names of any scientists living today who have been honored for their work? What is the best way in which boys and girls can honor the scientists who have made important discoveries about the human body and how it works?

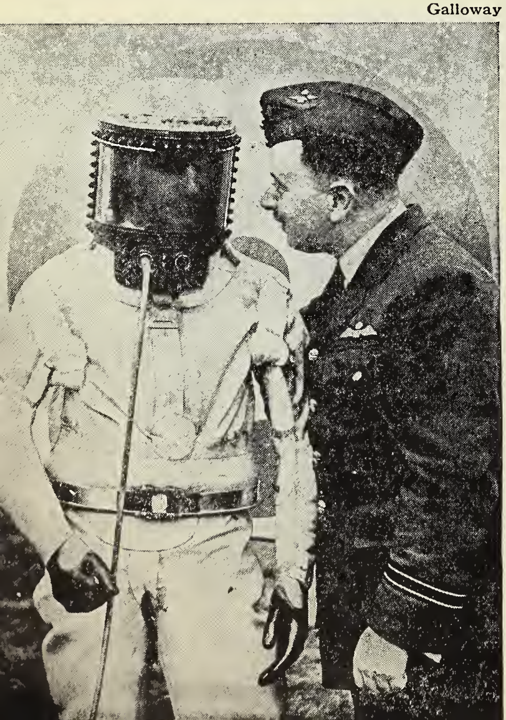
DO THESE THINGS

1. What are the measurements (height, width, length) of your classroom? How many cubic feet of air does it contain? How many cubic feet of oxygen does it contain? How many people are in the room? If each breathes half a cubic foot of oxygen per hour, how much does the whole class breathe?

2. If there is no air-conditioning system in your school, plan ways of using the windows to secure fresh moving air at all times without drafts. Study the air movements in various parts of the room by using thin strips of tissue paper, which flicker in a slight movement of air. Appoint a boy and girl each day to consult the thermometer and to report to the person who takes care of the stove or furnace when the temperature rises above 68 degrees Fahrenheit.

3. Find out more about air. How do scientists explain the fact that the earth has an atmosphere? What gases make up air and in what proportion are they mixed? What is meant by air pressure and air resistance? What are some of the dangers men must overcome when they explore the upper portion of the air? What name is given to the upper portion of the air?

Galloway



What dangers of flying in the upper portion of the air will be overcome by wearing this oxygen helmet and electrically heated suit?

UNIT IV

Food and How It Is Prepared for Use in the Body

Every form of life on the earth, from the lowest to the highest, manufactures its body out of food. How food becomes a part of us cannot be stated so simply. Making all the food we eat ready for the body cells to use is what is done in the process of digestion.

DO YOU KNOW

The three different purposes for which the body needs food?

What unit we use in measuring the fuel value of food?

Where digestion begins?

Why this boy and girl may have indigestion?

What bad eating habits make the stomach work overtime?

WHY THE BODY NEEDS FOOD

The food in a hen's egg is the perfect food for the chicken growing inside the shell. The food packed in a seed is the perfect food for a developing plant. The milk of the mother cow is the perfect food for the newborn calf. A mother's milk is the perfect food for her little baby. But the day comes when all young things must seek their own food. The baby chick, following behind its clucking mother, learns at last to scratch for juicy insects and to scramble for corn flung from the farmer's hand. The young plant sends down its roots into the earth and reaches its green leaves toward the sun for food. The calf leaves its mother's side to roam the meadow for sweet-topped clover. As the baby grows from infancy to childhood and youth, he eats first the food his parents give him, and then he begins to choose his own food. By learning what contributions different foods make to the upkeep and working ability of the body, and by using this knowledge in selecting food, he can largely determine the sort of body he will have through life.

The Body's Need for Sugar, Starch, and Fats

The body needs different kinds of food to use for different purposes. First, it needs food as fuel to keep the body warm and to pro-

Galloway

Learning to hunt for food is part of the training of baby chicks

Which kind of carbohydrate food is supplied by the plants these men are cutting?

duce energy for all the activities of the body. Without food we could not play, run, study, or work. Even if we lie perfectly still, the body needs energy for the beating of the heart, the act of breathing, and all the other activities which are constantly going on, although we seldom stop to think about them.

Most of the fuel burned in the body is supplied by the foods known as the carbohydrates and the fats. We get most of our carbohydrate foods from plants. Plants make two kinds of carbohydrate—sugar and starch. Since plants use sunlight energy in manufacturing carbohydrate, these foods are sometimes called energy foods. When we eat carbohydrate foods, such as bread or potatoes or sugar, the oxygen supplied by respiration unites with the carbon in the food, and sunlight energy is set free to do the work of the body.

The energy supplied by food is measured by a heat unit called a calorie. Foods are burned in the laboratory to find out how many calories, or heat units, each one supplies. In this way scientists have figured out the helpings of many different foods which are equal to one hundred calories. Individuals of different sizes and ages are also studied to find out how many calories are used in the body while they are resting and while they are engaged in many different activities. From such studies we know that boys and girls of from ten to thirteen years of age need from thirty-four to twenty-seven calories a day per pound of body weight.

Fats as well as carbohydrates are very good energy foods. Most of the fats that human beings eat come from animals. Examples of animal fats are butter, cream, lard, and fat meat, such as bacon.

The body needs food for growth and for the repair of its tissues, as well as for energy. The fabric, or substance, of the body is woven out of food, just as a woollen stocking is knitted out of wool. Worn-out parts in the body are mended with food, just as we use wool to darn a hole in a woollen stocking. Food must also supply the materials which provide ideal working conditions for the cells, and which give certain groups of cells the special substances they need in order to manufacture secretions necessary for the well-being, or good, of the whole body.

The Body's Need for Proteins

The principal building material of the body is protein. Protein can be burned in the body to produce energy, but it is used as fuel only when the body does not get enough sugar and starch and fat to keep it warm and give it the power to work.

Roberts

Cows supply us with the most valuable protein food of all—milk. A quart a day provides all the protein substances necessary for growth

The most important element in protein is nitrogen. The nitrogen which protein contains is the principal ingredient of every living plant and animal cell. Human beings get most of their proteins from animals. Milk, meat, fish, eggs, and cheese are all sources of the material with which our flesh and bones are made and repaired.

A body which is growing needs plenty of building materials for growth, as well as for the repair of worn-out parts. Boys and girls need more protein food than do grown-up people. How can boys and girls be certain that they are getting enough proteins of the right kind for body-building? Milk is the answer. A quart of milk a day supplies all the protein substances necessary for growth.

The Body's Need for Minerals, Water, and Vitamins

About $3\frac{1}{2}$ per cent of the weight of the body is made up of mineral elements. How many pounds of minerals does your body contain?

Mineral elements are used in the body both for building and repair and for regulating different activities. The two chief body-builders among the minerals are calcium and phosphorus. They are used in the largest amounts for building bones and teeth. Iron is another important mineral element. Hand in hand with phosphorus, iron forms a part of every cell; and, as you have already learned, it gives the red corpuscles the power to transport the two gases oxygen and carbon dioxide. The other mineral elements found in the body are distributed in various places where they are needed for the manufacture of different secretions, for cell-building, and for the composition of blood and lymph.

We draw on a great many different foods for our supply of minerals. Milk and cheese are the best sources of calcium and phosphorus. Iron is present in egg yolk, the blood of meat, liver, and in the green parts of plants and the outer coats of cereal grains. Many important minerals are found in fruits and vegetables. Since minerals dissolve easily in water, it is important to use the water in which vegetables are cooked to prepare soups and sauces.

Water is also used in the body as a building material. Every cell is made up partly of water. You may have heard or used the expression "bone-dry," but even bone is one-third water. The nerve cells of the brain are 85 per cent water; blood plasma contains more than 90 per cent and saliva more than 98 per cent.

In which vitamin are oranges especially rich?

Gendreau

Water helps to maintain an even temperature throughout the body. It makes it possible for us to move, as all the movable parts of the body are lubricated, or moistened, with water. Although water is not itself a waste, it is essential to the removal of wastes. Besides water itself, milk and other liquids, such as soups, cocoa, and the juices of fruits and vegetables, supply the body with the water which it cannot do without.

Vitamins are present in food in very small amounts, and yet they are essential to health and growth. If we do not have any one of them for any length of time we get sick or do not grow properly. Milk, cheese, butter, green and yellow vegetables, fruits, eggs, liver, whole-grain breads and cereals, and fish-liver oils are all valuable sources of vitamins.

Food for Every Day

When you are hungry, you do not say to yourself, "My, I hope my mother will have plenty of carbohydrates and fats and proteins and minerals and vitamins for dinner!" You think of food in the form in which it appears in the food stores or as it appears when cooked and served on your table.

In the following list foods are grouped according to their familiar names. If you eat foods from each group every day, you may be sure you are getting enough of the food substances which are called by their scientific names when it is necessary to explain the food needs of the body.

Milk

One quart a day. Part of this milk may be used on cereal and made into cocoa, creamed dishes, soups, and desserts, such as puddings and ice cream.

Eggs

One a day, either poached, boiled, or made into an omelet or a dessert. If you cannot have one egg a day, have at least four a week.

Potatoes

One helping a day, mashed, boiled, creamed, or baked.

Green and Yellow Vegetables

One helping a day of a cooked green or yellow vegetable, such as spinach, cabbage, beet tops, green string beans, turnip greens, chard, carrots, yellow turnips, or sweet potatoes.

One helping a day of a salad containing a raw vegetable, such as lettuce, cabbage, celery, carrots, or watercress.

It takes a lot of food to keep a scout going at a Boy Scout jamboree

Fruit

An orange, grapefruit, lemonade, a raw tomato, tomato soup, a dish of stewed tomatoes, or a glass of tomato juice once a day.

One other fruit, such as an apple, a banana, pineapple, figs, dates, or prunes once a day.

Bread and Cereals

One generous helping of a brown cereal with whole milk or cream each day. Four or five slices of bread or toast spread with butter, or rolls with butter. At least part of the bread should be made of whole wheat.

Meat, Cheese, Fish, Dried Beans or Peas

One helping of any one each day. Have liver once a week and fish, oysters, or clams once a week.

Water

Six glassfuls a day. Drinks made of fruit juice may be used as part of your water supply.

Fish-Liver Oil

In the wintertime some good source of vitamin D, such as cod-liver or halibut-liver oil or vitamin-D milk.

THE ALIMENTARY CANAL

Beginning in the mouth and ending in the large intestine the food we eat goes through a number of changes. The purpose of these changes is to make it possible for the food to become part of us. Complex substances must be broken down into simple ones and dissolved in water so that they can pass into the blood stream and be carried to all the cells in the body. This process is called digestion. It takes place in a tunnel called the digestive tract, or alimentary canal.

What Happens to Food in the Mouth

Digestion begins in the mouth. Here the food is ground by the teeth and mixed with a digestive juice called saliva.

Saliva pours into the mouth through ducts, or tubes, from the salivary glands. It starts to flow as soon as food is present. Sometimes the mere sight, smell, or even thought of food starts the flow of saliva and makes the mouth "water." A good appetite and cheerfulness at mealtime help to increase the flow of saliva and thus improve digestion. On the other hand, fear or worry may stop the flow of saliva even when food is in the mouth.

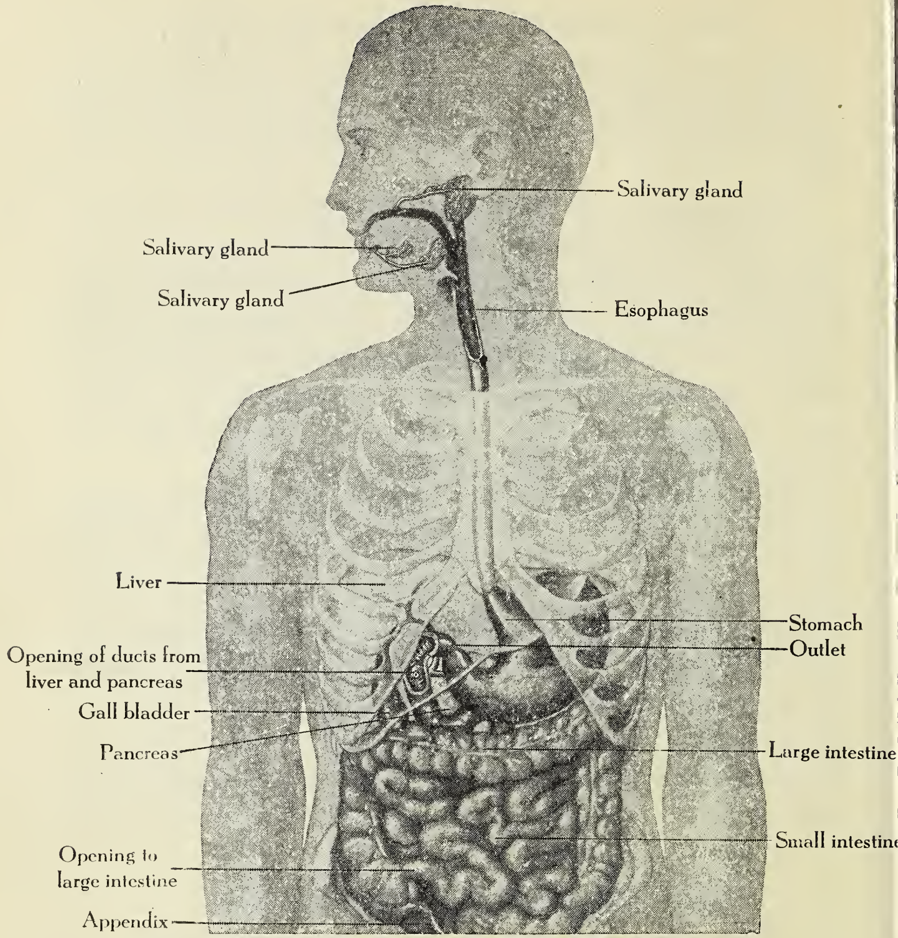
Saliva contains an enzyme, or digestive substance, which changes starch into sugar. Starch cannot be dissolved, but sugar can. By chewing food thoroughly, instead of washing it down with water or swallowing it half-chewed, we can aid the digestion of starchy foods. Even with thorough chewing, food does not stay in the mouth long enough for all the starch to be changed into sugar, and so the saliva mixed with it keeps on working after the food has reached the stomach.

What Happens to Food in the Stomach

From the throat the soft wet mass of chewed food passes down a muscular tube called the esophagus.

The stomach, into which food empties from the esophagus, is an elastic pouch, or bag. In shape the full stomach resembles a pear. The esophagus enters at the large upper end, which lies to the left of the middle line of the body. At the small lower end the small intestine opens.

As food pours into the centre of the stomach, it pushes



This picture of the alimentary canal shows the route
over which food travels in the process of digestion

the food already there toward the outer walls. By wavelike contractions of the stomach walls the food is thoroughly mixed with a fluid called gastric juice, which pours from glands in the stomach walls. This gastric juice digests the proteins in the food. The influences which increase or decrease the flow of saliva also affect the secretion of gastric juice.

When food is ready to leave the stomach and enter the small intestine, it is a soupy mass which collects near the outlet that leads into the small intestine. This outlet is guarded by a round narrow band of muscle. Pressure makes the muscle relax, and the mass is squirted into the small intestine.

What Happens to Food in the Small Intestine

When food enters the small intestine, it has travelled about two feet along the digestive tract. In the small intestine it travels from twenty to thirty feet. The small intestine lies coiled in the abdomen. It has elastic muscular walls, just as the stomach has, and its movements are a continuation of the wavelike contractions of the stomach. The lining of the small intestine is wrinkled into countless folds. From all the little ridges and valleys of these folds rise fine hairlike tissues called villi. In the villi tiny blood vessels and lymph vessels are coiled.

After the soupy mixture of food from the stomach has entered the small intestine, it is thoroughly soaked with secretions from three different glands. From the pancreas, pancreatic juice is poured into the upper end of the small intestine. It helps to finish the job of digesting starches and proteins and begins on the fats. The pancreatic juice is aided in its work of digesting fats by bile. This is a secretion of the liver, the largest gland in the body. Bile is stored in

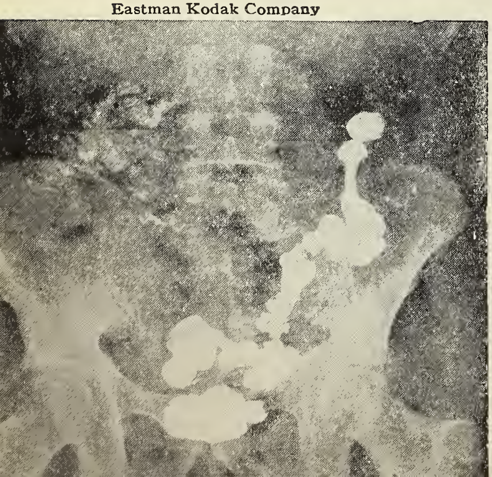
a small pouch called the gall bladder until it is needed. The third digestive secretion poured into the small intestine comes from glands in the lining and is called intestinal juice. Its action is similar to that of the pancreatic juice.

After the food in the small intestine has been acted on by these juices, it is a thin milky liquid substance. It is now ready to be absorbed. This process takes place almost entirely in the small intestine. The tiny blood vessels in the villi absorb, or soak up, the digested proteins, the sugar, and part of the digested fats. These are carried by the blood stream to the liver, where part of the sugar is taken out and placed in storage. The rest of the food absorbed then goes to the cells to help them to carry on their daily work. The remaining digested fat is absorbed by lymph vessels in the villi. The fat carried by the lymph finally enters the blood stream without having passed through the liver.

What Happens in the Large Intestine

The movements of the small intestine gradually pass the food along toward the large intestine. Food which has not been digested and absorbed in the small intestine finally enters this five-and-a-half-foot tube, or canal. The large intestine is shaped somewhat like a hurdle. It begins in the lower right-hand part of the abdomen, climbs up to a

Eastman Kodak Company



This X-ray picture was taken twenty-four hours after eating. The food which has escaped digestion is now in the descending section of the large intestine

point just under the lower ribs, crosses to the left, and then climbs down. The section at the lower end is called the rectum.

The food which enters the large intestine is a watery mixture of material which cannot be digested and a small portion of digestible material which for some reason has escaped the action of the digestive juices. During its passage through the large intestine most of the water is reabsorbed into the body, and the remaining mass of semisolid material is passed out through the rectum as waste.

It takes material from about three to six hours to pass through the small intestine and about twenty hours to go through the large intestine. Most people get rid of the waste matter accumulated in the lower part of the large intestine, or rectum, by a daily bowel movement.

People who have a lazy, or sluggish, intestine which does not empty regularly are said to be constipated. Some people have chronic, or long-continued, constipation because they have formed the habit of taking medicines called laxatives in order to make the bowels move. The habit of taking laxatives lessens the ability of the large intestine to move normally. Then more and more of the drug must be taken to promote what should be a natural activity of the body. To prevent or to cure constipation you should eat foods which contain plenty of roughage, such as green-leaf vegetables, raw fruits, whole-grain breads, and brown cereals; drink at least six glasses of water daily; and form the habit of going to the toilet each day at a regular time.

It is dangerous to take a laxative to relieve pain in the abdomen. Should the pain be caused by appendicitis, the laxative may cause the inflamed appendix to rupture. The appendix is a small, narrow pouch opening out of the large intestine. In case of continuing pain in the abdomen, call a doctor and *do not take* a laxative.

How Liquid Wastes Are Removed from the Body

The wastes removed by way of the large intestine are the parts of food that have escaped digestion and therefore cannot pass into the blood stream. The wastes which are carried in the blood to the places where they can be removed from the body are wastes produced by the working body cells. You have learned that the waste product carbon dioxide is carried by the blood to the lungs, where it leaves the body on each out-breath. Other useless and harmful waste substances collected by the blood from the working cells are carried to the kidneys for removal.

The kidneys are a pair of small bean-shaped organs located at the back of the abdomen. They are made up mostly of little hollow tubes packed closely together. At the beginning of each tube a tiny knot of capillaries is coiled. As blood flows through the capillaries, waste substances dissolved in water pass from the blood into the tubes. This liquid waste is called urine. The urine is carried from the kidneys to the bladder by two tubes called ureters, which are from ten to twelve inches long. The bladder is a hollow bag which holds the urine until it is passed out of the body.

The work of the kidneys is so important that the whole body may become sick if the kidneys are not able to do their work well. By making chemical tests of the urine a doctor can find out what substances the kidneys are removing or failing to remove from the blood. The germs in an infected tooth or diseased tonsils or the germs of a contagious disease produce poisons which may injure the kidneys. They may also be irritated by alcohol when a person is in the habit of drinking alcoholic beverages in large amounts. Chilling of the body may also inflame the kidneys so that they cannot do their work properly.

The waste substances removed by the kidneys must be dissolved in large quantities of water before they can pass from the blood stream into the kidney tubes. You help the kidneys in their work by drinking several glasses of water every day.

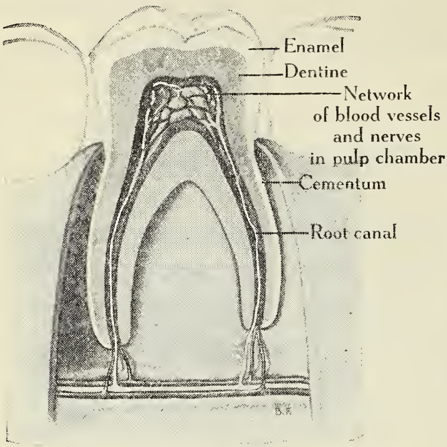
AIDING THE PROCESS OF DIGESTION

Digestion goes on automatically without any conscious direction from us. But there are many ways in which we can help to keep the machinery of digestion running smoothly. For example, we have almost complete control of the act of chewing. We are forced to breathe whether we want to or not, but we are not forced to chew our food thoroughly. If we wish to, we can only half chew it and wash it down with water or other liquids. But if we do this, the food will not be thoroughly mixed with saliva. Then some of the starch will not be digested. By chewing each mouthful of food slowly and thoroughly before swallowing it, we are able to get the most out of the starch in our food.

There is another important reason for chewing food well. If the food is not ground by the teeth into fine bits, the digestive juices in the stomach and small intestine cannot readily get at it to change it into the form in which it can be used by the body. Have you ever tried to sweeten lemonade with lump sugar? Powdered sugar dissolves in water or fruit juice much more quickly than lump sugar does. Food ground into small particles digests much more quickly and easily than does food in large unchewed lumps.

A much better job of chewing can be done by a set of strong sound teeth than by a set of decayed crooked teeth. Decayed teeth also are a menace to health because infection from them may be carried by the blood stream to other

parts of the body. In order to take proper care of the teeth we must eat foods which contain plenty of tooth-building materials, brush the teeth at least twice a day, and visit the dentist every six months.



This diagram is of a tooth cut lengthwise through the middle. Note that the material known as dentine forms the bony skeleton of the tooth and is protected by the hard white outer substance called enamel

Tooth-building materials are calcium, phosphorus, and vitamins A, C, and D. Milk is the best source of calcium, phosphorus, and vitamin A. From raw green-leaf vegetables, tomatoes, and citrus fruits, such as oranges, lemons, and grapefruit, we get our supply of vitamin C. Vitamin D, which enables the body to mix calcium and phosphorus together for building teeth and bones, is made by the body when certain short rays of the sun, called the ultraviolet rays, shine on the bare skin. As not many ultraviolet rays get through to us from the sun in the wintertime, we must get our needed supply of vitamin D in some other way during the winter months.

Vitamin D is not found in large amounts in any food except fish-liver oils, such as cod-liver and halibut-liver oil. The vitamin-D content of milk may be increased by exposing milk to the ultraviolet rays of a sun lamp or by adding to it a small amount of cod-liver oil. Such milk is called vitamin-D milk. You can make sure that you are

getting enough vitamin D to build strong sound teeth and bones if you play outdoors in the sunshine every pleasant day and take during the winter months cod-liver or halibut-liver oil or vitamin-D milk.

Vitex Laboratories Inc.

The vitamin-D content of this milk has been increased by adding to it vitamin D obtained from cod-liver oil

"Good Cheer" at the Table

You have learned that the flow of saliva and the secretion of gastric juice are both influenced by your feelings. You may have noticed a sudden dryness of the mouth when something has happened to shock or scare or anger you. Perhaps you have had indigestion, or an upset stomach, after eating when you were cross or worried or overtired.

Mealtime should be one of the pleasantest times of the day. A short rest before a meal is refreshing. Clean hands and face and well-brushed hair add to a sense of well-being. Worries should be left outside the dining-room. Quarrels should be settled somewhere else. A nicely set table, clean linen, appetizing food, good manners, pleasant talk, all help the body to digest food properly.

Today, when fathers and children leave at different hours for work and school and when they often eat lunch away from home, the family may see one another only in the evening. This makes it important that the evening meal should be a happy one.

After the meal it is best to avoid hard exercise for a short time. During the first half-hour or so after a meal the stomach needs extra blood to carry on the heavy work of digestion. Active exercise after a meal increases the blood supply to the muscles and lessens the supply to the stomach. Delay in digestion caused by an insufficient blood supply may result in indigestion.

Eating foods which are coated with fat delays digestion and thus keeps the stomach working overtime. For this reason fried foods should not be eaten often. Foods which are broiled, roasted, boiled, or baked are easier for the stomach to handle than foods which are fried.

The stomach has to keep on working as long as it contains food. It takes the average meal four to six hours to leave the stomach. The stomach does not have a chance to rest if it is overloaded with food between meals. Some boys and girls eat between meals because they fail to eat enough at mealtime, and they fail to eat enough at mealtime because they eat between meals. This is what is called a vicious circle. If you are one of these boys or girls, try to break the habit of eating between meals. You can do this by eating nothing between meals, no matter how hungry you get. Keep this up for a few days, and you will probably find yourself eating a good "square" meal three times a day. If you still get hungry, in spite of eating plenty of food at the table, drink a glass of milk or eat some fruit between meals at a regular time each day.

ARE YOU DOING YOUR BEST TO HELP THE BODY TO MAKE GOOD USE OF FOOD?

Do you eat each day foods that supply the body with all the different materials it needs to grow and to function properly?

Do you eat slowly and chew food well?

Do you avoid hard exercise immediately after a meal?

Do you eat at regular times and avoid eating between meals?

Do you wash your hands with soap and warm water before eating or preparing food?

Are you cheerful at mealtime?

Do you avoid eating when excited or overtired?

Do you have a bowel movement at least once a day?

Do you drink at least six glasses of water a day?

Do you brush your teeth in the morning and before going to bed?

Do you go to the dentist twice a year?

1. Complete each sentence below with a letter, word, or words from the box. (*Do not write in the book.*)

phosphorus	carbohydrates	calcium
milk	building	fats
calorie	D	C

a. The chief fuel foods are --?-- and --?--.

b. Proteins are used by the body chiefly as --?-- material.

c. --?-- is a food which supplies all the protein substances and many of the minerals and vitamins necessary for growth.

d. Teeth and bones are made chiefly of --?-- and --?--.

e. Raw green-leaf vegetables, oranges, and tomatoes are good sources of vitamin --?--.

f. Fish-liver oil is the best food source of vitamin --?--.

g. The heat unit used to measure the energy value of food is called a --?--.

2. Which of the following statements are true and which are false? Reword each false statement to make it true. (*Do not write in the book.*)

a. Digestion begins in the small intestine.

b. The stomach never changes in size.

c. A round narrow band of muscle controls the flow of food from the esophagus into the stomach.

d. When food is ready to leave the stomach, it is a soupy mass.

e. Digested food is absorbed in the small intestine.

f. The body gets rid of material it cannot digest by a movement of the bowels.

g. The kidneys remove carbon dioxide from the blood.

h. The body compels us to chew food thoroughly.

i. Cheerfulness aids digestion.

j. The stomach can digest a fried egg better than it can a boiled egg.

k. The large intestine can be trained to empty itself regularly.

3. Construct a table like the one on page 91. In the first column list all the digestive juices which act on food. Write

opposite the name of each digestive juice the information called for in the three remaining columns. (*Do not write in the book.*)

Name of Digestive Juice	Food Substance Acted On	Gland (or Glands) of Secretion	Place into Which Juice Flows
Saliva	*Starch*	*Salivary glands*	*Mouth*

THINK ABOUT THESE QUESTIONS

1. How does the knowledge that scientists have gained about the different food elements which the body needs help us to make good food choices? What are some of the ways in which we can learn to like foods that we do not like now?

2. What are the food materials which are needed for the building of a healthy body and for the performance of all its many activities? In what ways can you cheat your body of the materials it needs?

DO THESE THINGS

1. Regular gain in weight is one sign that you are supplying your body with the amount and kinds of food it needs to grow on. Weigh yourself each month and write down the amount you weigh each time. If you do not gain or are losing, try to find out why. There are many reasons for a failure to gain besides lack of the right kinds and amount of food. You may not be getting enough rest and sleep. Perhaps you need to have a physical examination in order to find out whether some condition in the body is preventing proper growth.

2. If you have a school cafeteria, check on the lunches chosen by children in the lower grades. Find out what important foods are missing in some of the lunches and plan ways of teaching the children better food choices. The home-economics teacher can give you great help in carrying out this project.

3. Chew a cracker or a piece of bread thoroughly for a few minutes. Of what food substance is the cracker or bread largely composed? Do you notice any change in taste after chewing

the cracker or bread thoroughly? What does this experiment prove about the action of saliva?

4. Rest for five minutes before a meal and then take your pulse. Take your pulse again after eating. Is there any difference in the rate? If so, what makes the difference? Use this information in explaining why hard exercise after a meal should be avoided.

5. Discuss in class ways of making mealtime a happy, pleasant time. Make a list of the funniest stories you have ever heard. Try telling one each night at the dinner table. Your stories will remind the other members of the family of stories which they have heard and which they will enjoy telling.

6. With your teacher's help or with the help of some older boy or girl, figure out the number of calories you take in during one day. To do this you should report the amount of food you eat by 100-calorie portions. Then figure out the number of calories you took in per pound of body weight. How does this number compare with the number of calories needed by boys and girls as given on page 72?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or terms:

accumulated	complex	gall bladder
element	alimentary canal	rectum
carbohydrate	duct	constipation
nitrogen	gastric juice	kidneys
well-being	enzyme	ureters
ingredient	appetizer	urine
mineral elements	pancreas	laxative
ultraviolet rays	pancreatic juice	vicious circle
expose	intestinal juice	
calorie	bile	

UNIT V

The Teamwork of Bones and Muscles

The form of the body, when the muscles are active in holding it in shape, is called posture. Posture is the noble sign of the vertebrates, the animals with backbones. Our ideas of the strength and grace of the human form come to us from looking at people who have won good posture by training their muscles and bones to work well together.

DO YOU KNOW

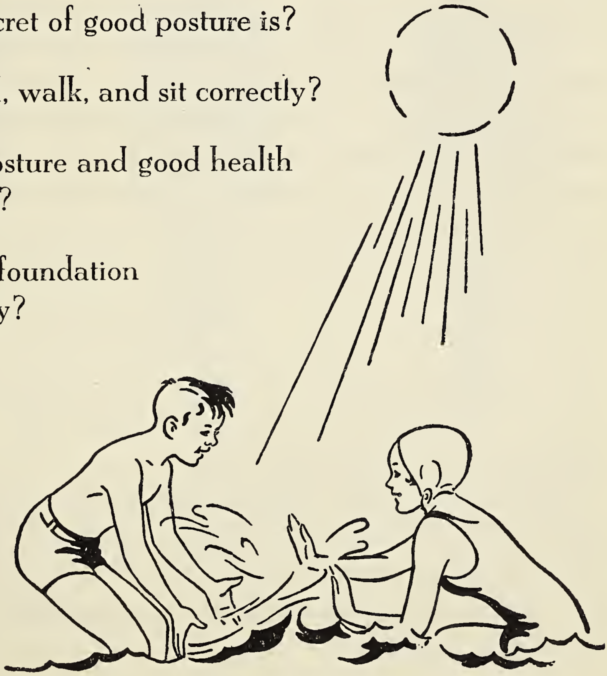
How sunshine helps to make bones hard and strong?

What the secret of good posture is?

How to stand, walk, and sit correctly?

How good posture and good health are related?

What is the foundation of the body?



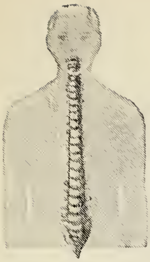
HOW BONES AND MUSCLES WORK TOGETHER

The body is built around a framework of bones, just as a house or a skyscraper is built around a framework of wood or steel. The bones of the feet serve as the foundation, and the backbone, or spine, is the central, or main, support. The pictures on the opposite page show how the bones are built up around the spine as the great supporting centre for the whole skeleton.

What Bones Are Made Of

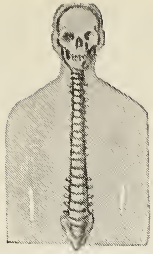
By looking carefully at a bone cut crosswise you will see that toward the outside it appears to be solid like ivory and toward the inside it is dotted with tiny holes like a sponge. The tiny holes which give a spongy appearance to the inside of a bone cut crosswise are the cut ends of canals which enclose blood vessels and nerves running through the bone. As a matter of fact, the whole bone is tunneled with these canals, but they lie closer together toward the inside of the bone than they do toward the outside. The blood vessels and nerves enter these canals from a thin skin called periosteum, which covers the bone except at the very ends. Surrounding each canal and connected with it by still smaller canals are the bone cells. The bone cells deposit the mixture of calcium and phosphorus which helps to make the bones stiff. Vitamin D enables the cells to do this work.

The way to grow strong straight bones is to eat daily such foods as milk and cheese, which contain calcium and phosphorus, and to get plenty of sunshine in summer and to take fish-liver oil or vitamin-D milk during the winter months.



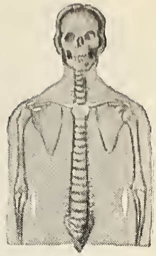
a

The central, or main, support of the skeleton is a column of irregular ring-like bones called the backbone or spine



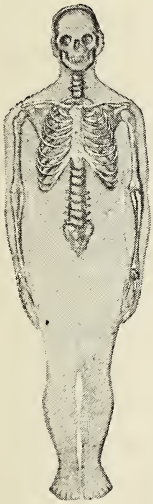
b

At the top end of the spine are set the bones which are dovetailed together to form the cavity which holds the brain



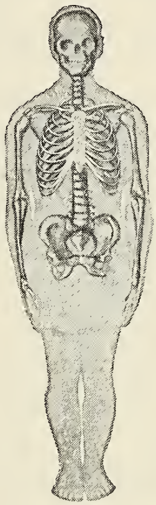
c

The arms are attached to the shoulder girdle, a bony ring formed by the shoulder blades and the collarbone



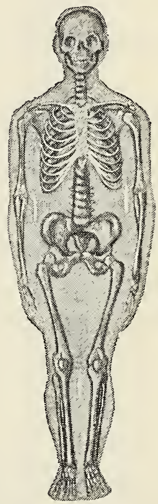
d

The ribs and breastbone form the chest cavity, or room, which contains the heart and lungs



e

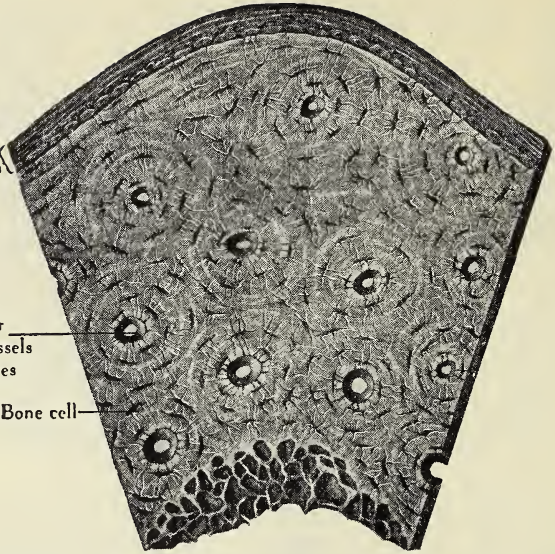
A ring of heavy bones at the lower end of the spine holds up the organs in the abdomen



f

The legs are fitted into the ring of heavy bones at the lower end of the spine

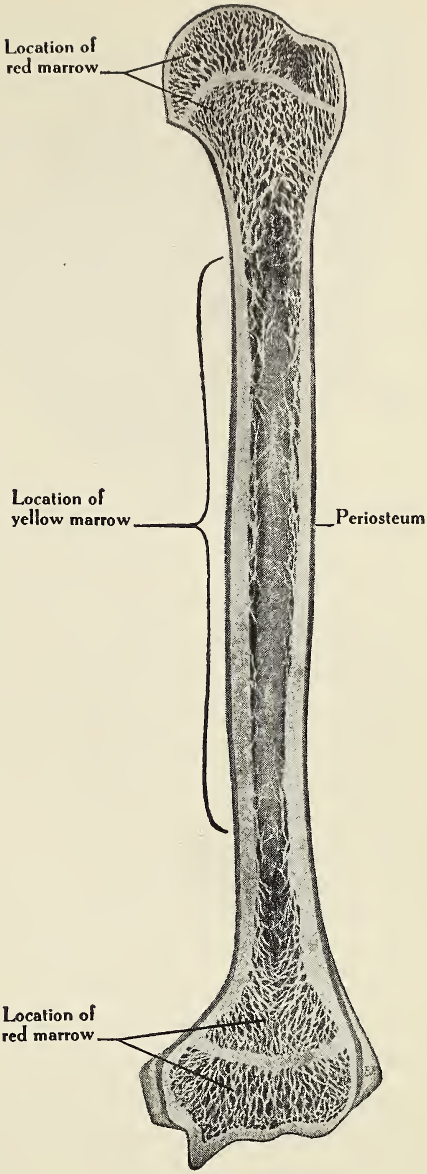
How the skeleton is built up around the spine



Section of a bone cut crosswise and magnified to show its structure

The long bones contain a spongy substance called marrow. There are two kinds of marrow, red and yellow. The red marrow is found in the spongy tissue toward the ends of the long bones, and the yellow marrow is found in a canal running up through the centre of these bones. You have learned that red marrow contains cells which act as little factories to make the red corpuscles of the blood. Foods that contain iron, such as eggs, liver, and spinach, supply the cells in the red marrow with iron for building red corpuscles. The yellow marrow is made up mostly of fat cells. In the round piece of bone which you will find in a slice of ham, you can see the fatty marrow in the centre. After the ham is cooked, you can push out the marrow with your finger. The next time you have chicken for dinner ask for a drumstick. If you break apart the bone in the drumstick, you will see the soft marrow which fills the centre of the bone and the marrow in the spongy tissue at the ends.

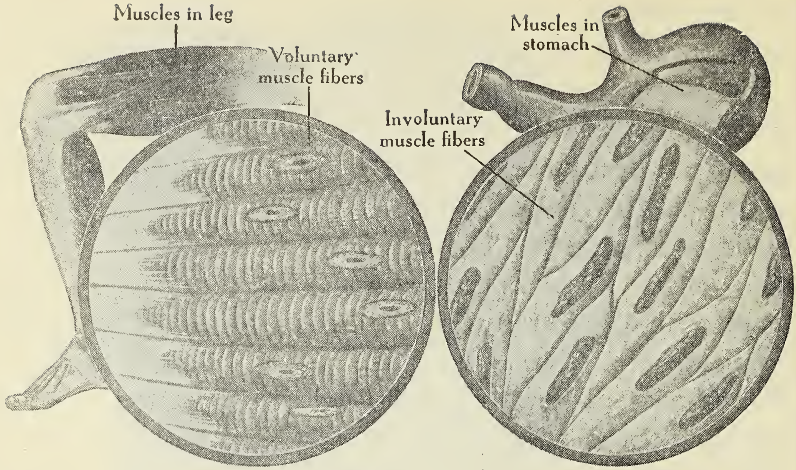
The places in the skeleton where one bone joins another bone are called joints. A jacket of strong connective-tissue fibers, called ligaments, binds bones together at the joint. A smooth tough substance called cartilage covers the ends of the bones. The cartilage in turn is covered with a thin membrane which secretes a thick fluid like the white of egg. This fluid oils the joint so that, in moving, the movable bones rub against each other without pain, friction, or creaking.



A long bone cut lengthwise, to show the location of the red and yellow marrow

Muscle Power

The unit of a muscle is a long slender cell which is called a fiber because of its threadlike shape. This cell has the power to bunch up, or contract, into a short, thick cell when it is stimulated by the motor-nerve fiber leading to it.

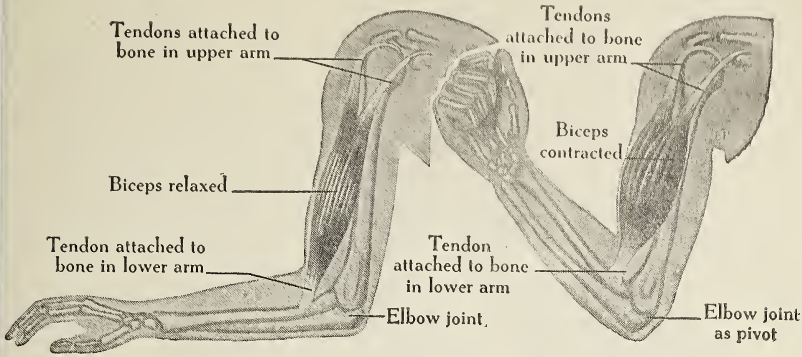


What is the chief difference between voluntary muscle fibers and involuntary muscle fibers?

A muscle is made up of thousands of fibers bound together by connective tissue. When we speak of muscles, therefore, we mean such bundles of muscle fibers.

There are three kinds of muscle fiber. Muscles which are attached to bones are made up of cross-striped fibers. Such muscles obey the will and are called voluntary muscles. Muscles like those which are found in the walls of the stomach and small intestine and which do not obey the will are made up of smooth fibers and are called involuntary muscles. The heart has special muscle cells which give it the power to keep up a system of regular beats from the beginning of life to the end.

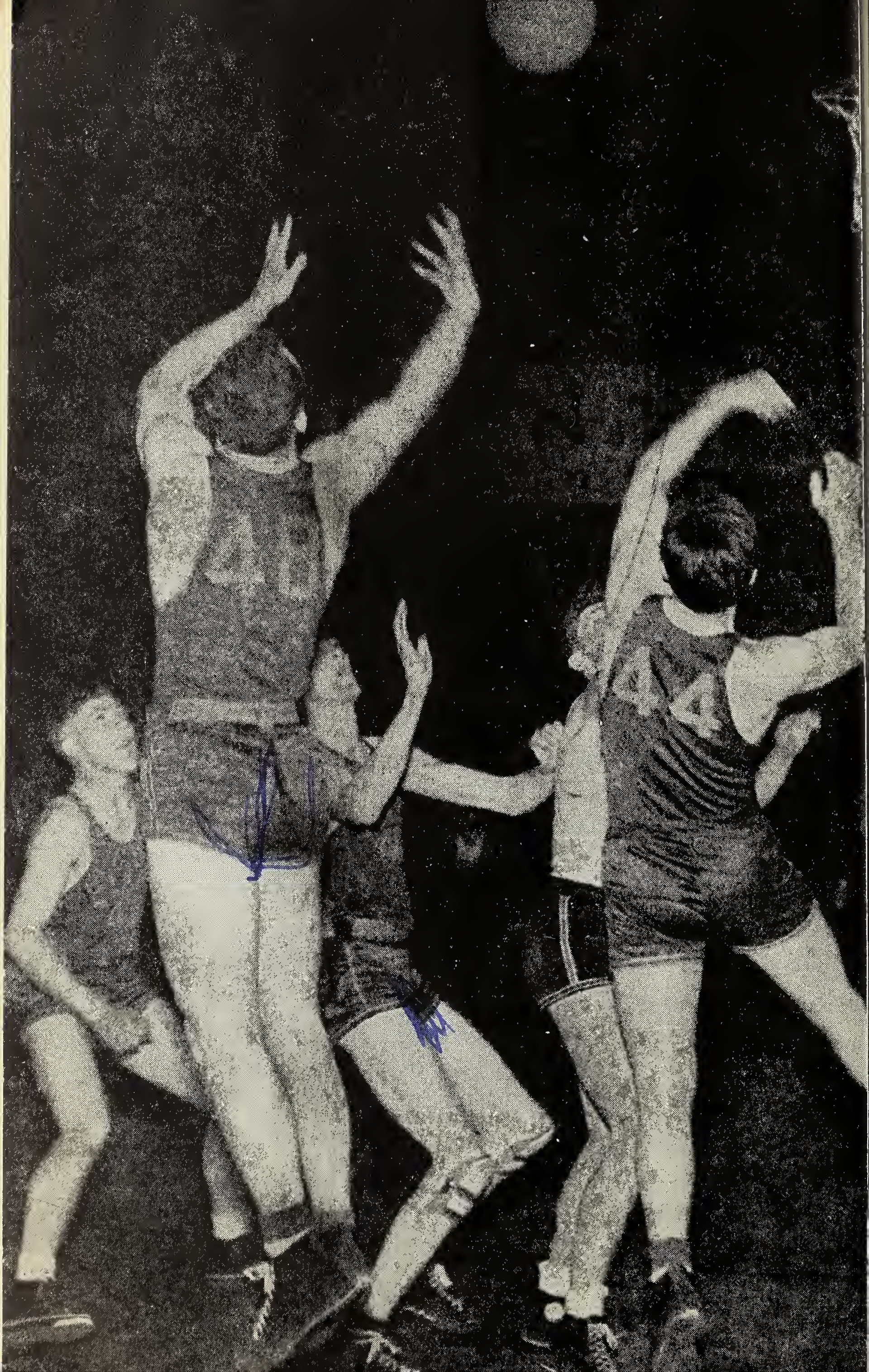
You have learned that all the physical work of the body is performed by the muscles. They are like engines which furnish power. But power must be harnessed, or applied, if it is to be of any use. A swiftly flowing stream of water has power. But it is only when men lower mill wheels, for example, into the stream that the power can be used to



How muscles move bones

run machinery. The movable bones of the skeleton are moved by power supplied by the voluntary muscles. These bones, with muscle power driving them, make it possible for you to perform voluntary movements, such as those of standing, walking, running, sitting, and chewing, of grasping, lifting, and carrying objects, and of all the skillful operations carried out by the hands and fingers.

The voluntary muscles are fastened to the bones by means of strong cordlike tissues called tendons. We may compare them to the ends, or cords, of a woven hammock by which the hammock is slung between two points. If a muscle is slung between two bones by its tendons, we can see that the shortening, or contraction, of the muscle will cause a movement at the joint where the bones are connected. This may be seen in the big muscle at the front of the upper arm, called the biceps. Its upper tendon is fastened to the bone of the upper arm and its lower tendon to one of the bones of the forearm. Its contraction therefore causes movement at the elbow joint. Muscle and bones together form a lever with the joint as the pivot. You can see that a muscle becomes shorter and thicker when it contracts by feeling your biceps as it lifts your forearm.



Our Contrary Muscles

Wherever there is a muscle whose contraction causes movement at a joint in one direction, there is another muscle whose contraction causes movement in the opposite direction. That is, the muscles work in pairs to bring about movements. While one contracts, the other relaxes. For example, when the biceps contracts, the elbow is bent and the forearm is pulled up. But at the back of the arm there is another muscle, which contracts to straighten the arm again. Actually when we use our arms and legs, whole groups of muscles act together. At least half a dozen are used to perform the simplest action. In many exercises, such as those of tennis and baseball, almost every muscle in the body is brought into play, and skill in these exercises is shown by the speed and ease with which the muscles and bones work together.

When you remember that each muscle is made up of thousands of muscle fibers and that each muscle fiber is connected with the brain by a nerve fiber, you can imagine the bustle which goes on in the brain while you are playing a game which requires the sending of motor impulses every instant over thousands of nerve fibers to thousands of muscle fibers.

Learning to Relax

It is a great gift to be able to allow the muscles to relax, or go limp, several times a day and especially before and after meals. The people who have acquired this habit can do more and better work while they are active because their bodies have had more rest. Also, the se-

e teamwork. Brain and
ıuscles and bones trained to
work together make possible the
skill of these basketball-players

Keystone

Steven A. Coons

Learning to relax

cret of going to sleep quickly lies in knowing how to let your body go limp as soon as you are comfortably settled in bed. If you learn the difference between a limp muscle and a tight one, you will know when your body is relaxed and when it is tense, or tight.

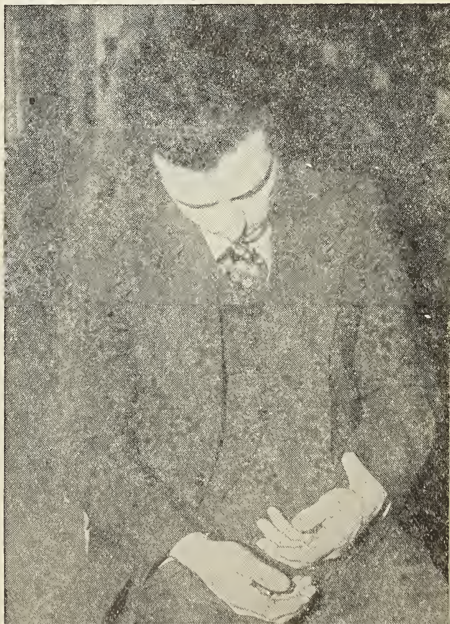
Lie on a bed or sofa and bring your right hand sharply up to your right shoulder and hold it there tight. Feel the muscle in your upper arm. It is tight and hard, or tense. What causes the tenseness? It is effort. That is, the muscles of your arm have to work in order to bring your hand to your shoulder and keep it there. Now let your right arm lie limply at your side. Feel the muscles in it with your left hand. They are soft and loose. Your arm does not need to work when you allow it to go limp. Tenseness means effort. Relaxation requires no effort.

Why We Can Stand Erect

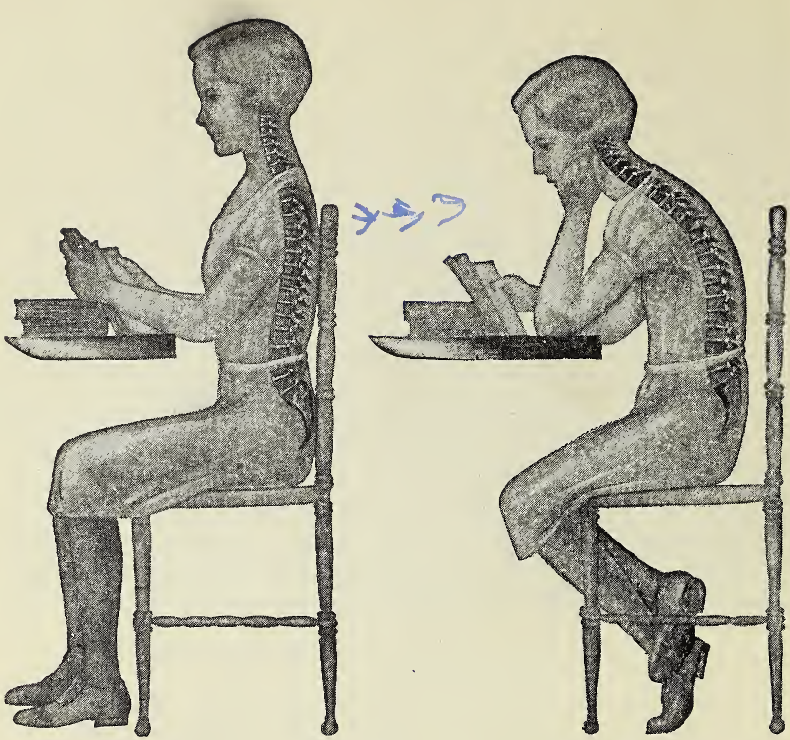
Muscles make it possible for us not only to move but also to hold the body erect. The arrangement of muscles in pairs which work against each other makes it possible for us to keep our balance. One group of muscles contracts, or pulls firmly in one direction, while the opposing group of muscles relaxes, or lets go. The heavy head is kept from drooping forward on the slender neck by muscles which rise from the bones of the spine and shoulders and from the ribs. These muscles pull the head backward. While the back muscles are pulling the head back, other muscles in the front of the neck keep the head from being drawn too far backward. If you wish to nod to a friend whom you happen to meet, the back muscles relax and the front muscles contract and draw the head forward. You may have noticed someone sleeping in a chair. The head falls forward on the chest because the pull of the muscles is controlled by the brain, and when a person has fallen asleep a large part of his nervous system is resting.

The trunk of the body is held erect by powerful muscles in the back which keep it from falling forward. If you wish to stoop over, these back muscles relax and powerful muscles in the abdomen contract and pull the trunk over frontward. The muscles in the abdomen also keep the back muscles from pulling the trunk too far back.

Underwood & Underwood



Why has this sleeper's head fallen forward on his chest?



Notice the unnatural curve of the spine
when the body is allowed to slump forward.
Even the belt of the girl at the right
sags down with her sagging waistline

THE SECRET OF GOOD POSTURE

The secret of good posture is the secret of balance. High up in the Berkshire Hills in New England there is a famous rock called the Balancing Rock. It has stood there for centuries, supported in perfect balance. The huge rock rests upon a foundation of two small stones. If one of these stones slipped out of place, what would happen? What happens when the foundation of a building is weak-

Perfect balance. What would happen to the boy at the top of the pyramid if one of the boys forming the base slipped out of place?

ened? Have you ever thought of your feet as the foundation upon which the body rests? If in standing or walking one part of the body, such as the head, droops forward, then some other part of the body, such as the upper part of the spine, must curve outward and backward to maintain the balance over the feet. If you keep this in mind, you will see the reasons for the directions given for correct posture in standing and sitting.

To stand or walk correctly hold the body as tall as possible without rising on the toes. Hold the head up and the chin in. Hold the shoulders level, and keep the chest high and the abdomen in. Let the arms swing naturally at the sides. In standing the knees should be straight and the feet placed from two to four inches apart with the

toes pointing straight ahead. Stand at ease without muscular effort or strain. Otherwise the muscles will soon become tired, and the body will droop from fatigue. In walking the body should sway forward at the ankle so that the chest is in line with the toes.

In order to sit correctly you must have the proper kind of chair. The height of the chair seat should allow the feet to rest firmly on the floor. In many schools the desk seat is adjusted to the length of its owner's legs. The back of the seat should give support to the curves of the back. If you will sit erect and gradually relax, allowing your back to bend naturally, you will find that there is a point in the middle of the back which bulges out. To prevent fatigue the seat back should give support to this bulge, as well as to the shoulders. It is important to sit back in the seat in order to make use of the support of the seat back. In leaning forward bend from the hips and not from the middle of the back or from the shoulders.

Correct posture gives all the organs of the body room in which to do their work properly. It also gives them the support they need. If a person habitually stands or sits with his chin on his chest and his shoulders drooped forward, his chest becomes narrowed. Then the heart and lungs are crowded.

Which of these boys has learned the importance of good posture? Which one do you prefer looking at?

ARE YOU DOING YOUR BEST TO DEVELOP A STRONG GRACEFUL BODY?

Do you have a quart of milk each day?

Do you exercise outdoors in the sunshine every pleasant day?

Do you take cod-liver oil or some other good source of vitamin D during the late fall and the winter months?

Do you practice the correct positions of the body in standing, walking, and sitting?

Do you wear only well-fitting clothes and shoes which place no strain or heavy weight on the bones or muscles?

Do you sit only in chairs or seats which support the lower part of the back and which are low enough for the feet to rest flat on the floor?

Do you sleep on a mattress which is firm enough to keep the body from sagging down into it?

Do you relax several times a day to rest the muscles?

1. In the numbered list below are definitions; in the box, the words defined. On a separate piece of paper write the numbers 1 to 12. Opposite each number write the letter of the word or words defined. (*Do not write in the book.*)

a. Joints	*g.* Vitamin D
b. Involuntary muscle fibers	*h.* Feet
c. Spinal column	*i.* Voluntary muscle fibers
d. Skeleton	*j.* High-heeled shoes
e. Tendons	*k.* Calcium and phosphorus
f. Balance	*l.* Limp muscles

1. Framework of the body.
2. Principal materials of which bones are made.
3. Food element which makes it possible for bone cells to deposit stiffening material.
4. Meeting place of the bones.
5. Cross-striped muscle fibers.
6. Smooth muscle fibers.
7. Tissues which connect muscles with bones.
8. Main support of the body framework.
9. Secret of good posture.
10. Relaxation.
11. Foundation of the body.
12. A possible cause of poor posture.

2. Some of the following habits promote good posture; others promote poor posture. Copy each group of words on a piece of paper and write a plus sign (+) before each group that names a good habit and a minus sign (–) before each group that names a bad habit. (*Do not write in the book.*)

Exercising out of doors each day.

Carrying a heavy load of books habitually with the same arm.

Walking or standing with the head up, the chin in, the chest high, and the shoulders level.

Standing and walking with the hands in the pockets.

Drinking three glasses of milk a day.

Taking sun baths in summer and cod-liver oil in winter.

THINK ABOUT THESE QUESTIONS

In walking through the woods have you seen little trees standing tall and straight and others twisted out of shape? Have you ever tried to straighten a little tree? Have you ever seen in parks or orchards or plant nurseries young trees which are tied to stakes? Do you know why they are tied in this way? Have you ever seen a stake tied to a big tree? Is it possible to straighten an apple tree or a beech tree or an elm tree which has its full growth?

Why is the time of growth the time to correct faults in posture and defects in body structure which can be corrected?

DO THESE THINGS

1. If there is a microscope in your school, make arrangements to examine a small piece of bone and a small piece of meat under it. Do they have different patterns? Note the difference between the way in which each substance looks to the naked eye and the way in which it looks under the microscope. Does this give you an idea of the value of the microscope in exploring the human body?

2. Read the story "The Strange Case of Dr. Jekyll and Mr. Hyde," by Robert Louis Stevenson. Show how Dr. Jekyll would stand and walk. Then take the part of Mr. Hyde.

3. If there is an art museum in your community, visit it and look at the pictures and statues with an eye to posture. Your teacher may be able to secure a set of prints of great paintings and statues for you to examine. You may also collect pictures of people from magazines

Why is this young tree tied to a stake?

or other sources. Discuss in class the use which artists make of posture to express such qualities of mind or body as dignity, grace, youth, old age, strength, weakness, cunning, meanness, joyousness, sorrow.

4. It would be interesting to have snapshots taken of each member of the class. If possible, have two views taken, one from the front and one from the side. (Stand naturally when your picture is taken; do not for the moment stand straighter than you usually do.) Study the snapshots of yourself to find out whether you have a good standing posture. Are you pleased with what your posture tells other people about yourself? Compare the snapshots of yourself with pictures showing good posture. If you think your posture can be improved, show the snapshots to your physical-education teacher and ask him to give you some exercises that will help you to strengthen the muscles that support the bones of your body.

5. Find out about boys and girls who lived in Athens in the Golden Age of Greece (400–300 B.C.). What sort of care did they give their bodies? What games did they play? What was the greatest ambition of every boy? How did he set about realizing it? What Greek athletic event do we celebrate today? What is one of the greatest honors a modern athlete can win?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words:

posture	tense	friction	balance
vertebrate	tenseness	tendon	disk
periosteum	relaxation	biceps	abdominal
involuntary	joint	lever	
apply	ligament	pivot	

2. From the list above select the word defined by each one of the following:

Large muscle in the upper arm, having a backbone, rubbing, skin covering the bones, mechanical device for raising objects, something upon which another thing turns, flat circular object.

UNIT VI

The Outer Covering of the Body

The tight-fitting, elastic, unbroken covering of the skin, which grows as we grow, protects the body by keeping out germs which might cause a serious infection inside the body. If we had no skins, we could not live. And yet we are always losing our skins.

DO YOU KNOW

How we "lose our skins"?

Why some people are blonds and others brunettes?

Why some people have straight hair and other people have curly hair?

Why we can cut our finger-nails without feeling pain?

Why plain water runs off the body without wetting it thoroughly?

What athlete's foot is?

WHAT THE SKIN IS LIKE

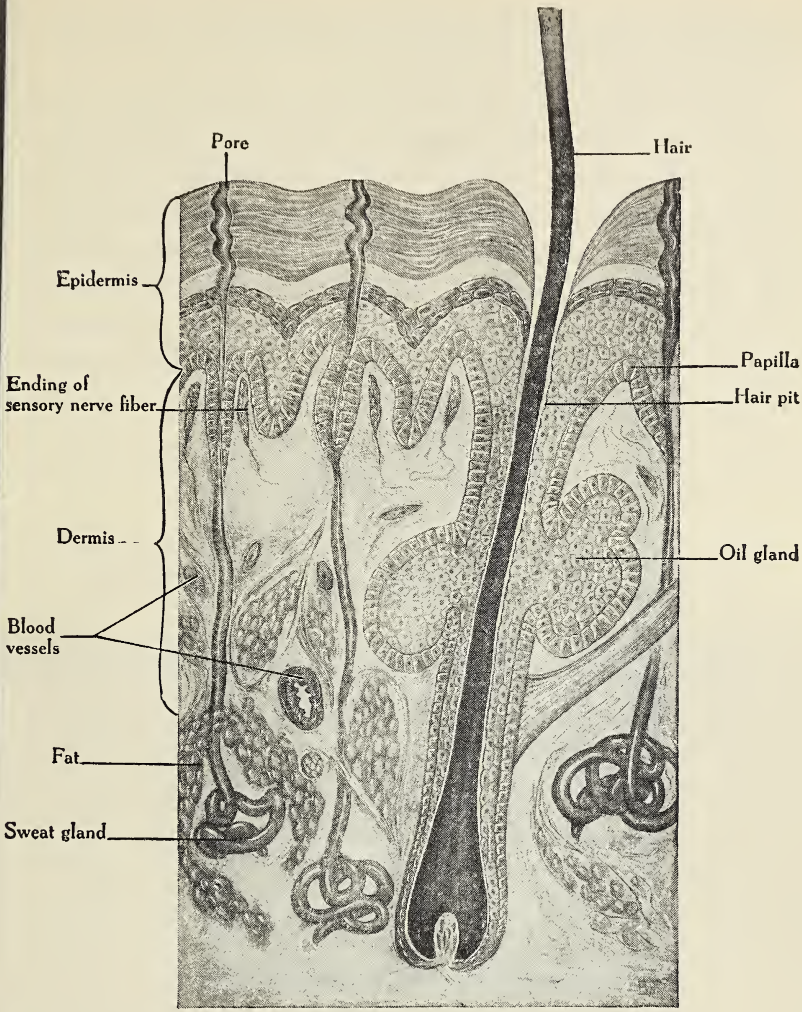
Skin is made up of two distinct parts: the epidermis and the dermis. The epidermis is the outer part. It consists of four layers. The cells in the three upper layers are practically dead. The living cells in the deepest layer receive their nourishment from blood which runs in the tiny capillaries through the true skin, or dermis, lying directly beneath. There are no blood vessels in the epidermis.

The true skin, or dermis, forms little hills, called papillae, which push up into the epidermis. The tiny ridges and valleys which we see in the skin on the palms of the hand are formed in this way. The undersurface of the dermis rests on a layer of fat.

The living cells in the deepest layer of the epidermis are continually multiplying. As they multiply, they push upward the older cells previously formed. In the top layer of the epidermis—the layer you see—the material of which the cells are composed has become changed into a substance called keratin. Your hair, toenails, and fingernails, and the horns and hoofs of animals also are made of this substance.

We are constantly shedding the outside surface of the epidermis in the form of dry scales. This is very noticeable after a severe case of sunburn or during recovery from a disease which affects the skin, such as measles or scarlet fever. It is less noticeable at other times, but it is always going on. The scales are washed off in bathing the skin. The deposit, or "ring," which you see in a bathtub after you have drained the tub is a collection of these scales mixed with the dirt that has been removed from the surface of the skin.

The color of the epidermis is the color of horn. But skin does not usually look pale and hornlike. When the whole body is healthy, the blood also is healthy; that is,



This drawing shows what the different layers of the skin look like under the microscope

"

it contains, among other things, its full quota, or share, of red corpuscles. The redness of the blood in the dermis shines up through the epidermis, and the skin looks rosy. This is especially true of the cheeks, lips, and ears, as there

are a great many blood vessels in the dermis of these areas, and the epidermis is very thin.

There is also coloring matter in the dermis itself. This is called pigment. The amount of pigment present determines our coloring. A great deal of pigment in the skin makes a person dark-colored, as in the case of the Negro. Blond people have very little pigment; brunettes have more. The albino has none at all. Your coloring is inherited, but it also depends upon how much sunlight you get. The ultraviolet rays of the sun tan the skin, either in spots called freckles or with a deep even brown, or tan.

How Hair Grows

Hairs grow out of the epithelial cells of the skin. There are no holes in the surface of the skin to let the hairs through, like the holes we make in cloth with a needle to let the thread through. Instead the outer layer of the skin is folded into little pits which extend down into the dermis and even into the layer of fat beneath. From the bottom of each little pit a hair grows. Hair goes through the same change as do the epithelial cells of the epidermis. The hair cells touching the dermis get plenty of nourishment and are living. As they grow, they push ahead of them a column made up of dead cells which have been changed into keratin, just as an engine working from behind may push ahead of it a row of freight cars. These living, growing, pushing cells will also die when they get so far away from the dermis that they can no longer secure nourishment.

The color of the hair depends on the pigment in the dermis around the living hair cells. Usually it matches the coloring of the skin. That is, brown-skinned people, or brunettes, have dark hair, and fair-skinned people, or

blonds, have light hair. This is not always true, however, as there are some people with fair skins and dark hair and some with olive, or pale-brown, skins and light hair.

The shape of the pit out of which the hair grows determines whether or not the hair is curly or straight. If the pit is round and straight up and down, the column of hair growing out of it is also round and straight. If the pit is bent or flattened, the hair is flat and wavy, or curly. You know by observation that a substance squeezed out of a round hole is round; out of a flattened hole, flat. In making "dandelion curls" you have probably discovered that the round tube of the dandelion stem will not curl; but if it is split down the middle and flattened, it can be

Curlylocks.
What shape is the hair pit out of which her hair grows?

From *All the Children*

made to curl. Thin flat wood shavings will curl. A thin round stick will not curl. Curling hair with an iron flattens out the hair and presses it into the shape of a curl.

The fingernails and toenails also grow out of the epithelial cells of the skin. At the base of each nail the skin folds back to form a slit. At the bottom of the slit living epithelial cells growing outward push ahead the thin horny sheet of cells which have died for lack of nourishment. The white half-moon at the base of the nails marks the point where the living cells end and the dead cells begin.

Oil and Sweat Glands

Out of each pit in which a hair grows two or more little pouches, or sacs, open to form the oil glands of the skin. The greasy secretion of these glands helps to keep the skin smooth and flexible and the hair soft and glossy.

The sweat glands are long slender coiled tubes formed by a folding in of the outer layer of skin, or epidermis. The openings of these tubes are called pores. The tubes extend far down into the dermis, where they take from the lymph in the dermis the fluid which they secrete. We call this fluid perspiration, or sweat. It is slightly oily, salty water.

When we are very hot the body speeds up the production of sweat in order to furnish more water to be used in getting rid of heat by evaporation.

SKIN TROUBLES

Sometimes here and there on the skin the pores become clogged with a mixture of hardened fat from the oil glands of the skin and the dirt caught in it. This collection of grease and dirt in a pore is commonly called a blackhead. People whose oil glands are overactive and who are careless about keeping the skin clean are the ones who most

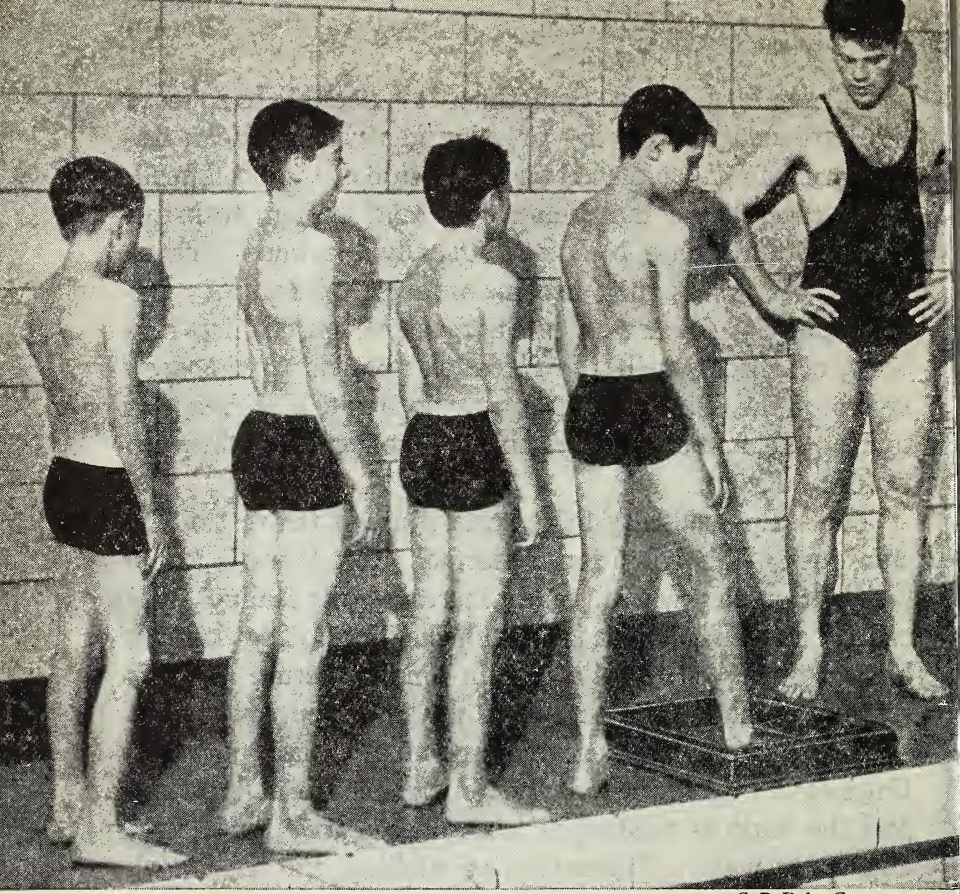
often have blackheads. Sometimes it is possible to squeeze the hardened dirt out by pressing gently with clean fingers or clean gauze placed on either side of the blackhead. In no case should the pressure be hard enough to break the skin and cause bleeding. Usually blackheads cause no trouble unless they become infected. Then they become pimples filled with pus and may even develop into boils, or abscesses, if the infection spreads to the deep layers of the skin. The best way to avoid blackheads is to keep the skin clean by washing it frequently with warm water and soap.

The scalp sheds dry flaky scales, just as the rest of the skin does. This condition is normal. But there is a disease of the scalp which greatly increases this scaling. It is called dandruff. The cause of this condition is not known, but it is believed to be a certain kind of germ. For this reason you should be careful to use only your own comb and brush and to wear only your own hat. Dandruff sometimes clears up of itself if the general health is improved and the scalp is washed at least once a week with soap and warm water. Massaging, or rubbing, the scalp each day and brushing the hair vigorously help to keep the scalp clean and healthy.

Certain little insects, such as lice and itch mites, irritate or infect the skin if they get a foothold. They are easily spread from one person to another.

One kind of louse, called the head louse, makes its home on the scalp. The eggs from which lice grow are called nits. The nits cling like glue to the hair and are difficult to remove. The lice irritate the scalp and cause itching. Having lice is called pediculosis (from *pediculus*, the Latin word for "louse").

By wearing only your own hat and coat and using only your own hairbrush and comb, you may escape head lice.



C. B. Dolge Company

These boys are washing their feet in an antiseptic solution before taking a swim in the school swimming pool. What disease are they helping to control?

If you get them, your mother or the school nurse will tell you how to get rid of them. It has been said, "No one should be blamed for having lice, but only for keeping them."

Ringworm of the feet, or "athlete's foot," is a communicable skin disease which affects the skin between the toes. The skin in this area becomes cracked, inflamed, or red, and crusty at the edges. It itches badly. Ringworm is caused by a tiny plant called a fungus which can be seen

only under the microscope. The disease is caught by walking barefoot on surfaces over which people with ringworm have walked. Anyone who has ringworm or any other infection of the feet should consult a physician.

To protect other people, boys and girls with ringworm of the feet should not walk barefoot at home or in public places or use public shower baths or swimming pools. Many schools provide foot baths containing an antiseptic solution which boys and girls are required to use before and after using the pool or shower bath.

THE CARE OF THE SKIN

Have you ever heard it said, "Beauty is only skin-deep"? This means that a person should not be judged by his looks alone, because he may possess a character worth far more than a beautiful body. But even outward physical beauty is more than skin-deep. The skin itself is not beautiful. Is the skin you peel from a dry blister lovely to look at? If you had a very thin sheet of the pale-yellow horn out of which people used to make window-panes, you would have some idea of what the outer skin—the skin that people see—looks like. If you placed this horn in a window facing the red setting sun, the whole sheet would glow with the color of the sunset. The horn would then be beautiful, as the skin is made beautiful by the glow of the red blood underneath.

Because the skin is an organ of the body, and as much a part of it as the heart or lungs or any other organ, its appearance depends first of all on the health of the whole body. From the food you eat the skin gets its nourishment. It needs especially the minerals and the vitamins which you get mostly from milk, green and yellow vege-

tables, fruits, the yolks of eggs, and fish-liver oils. Exercise brings the blood racing to the skin and acts as a tonic. Rest and sleep smooth out the little wrinkles which sometimes come from the cares of the day and rub out the dark circles which fatigue paints on the skin under the eyes. There is one service which you do for the skin but do not do for any other organ of the body. Do you know what this service is?

You have learned that some of the body fat oozes out of the oil glands in the skin. This oil keeps the skin soft and flexible, but it also catches dust and dirt from the air. Sweat, which is constantly poured out on the surface of the body, deposits on the skin a thin layer of grease and salt. This deposit sometimes has an unpleasant odor. Also the clothing worn next to the skin may become greasy and soiled, although it may not look dirty. This is why you should put on clean underclothing and stockings each day, if possible, and always after an all-over bath.

In order to wash away the deposit of sweat and dirt and dead-skin scales caught in the oil on the skin you must wash your body all over with soap and warm water. If you cannot take an all-over cleansing bath daily, you should at least wash thoroughly each day the face, ears, neck, hollows under the arms, and feet. An all-over sponge bath, shower, or tub bath with warm water and soap should be taken at least twice a week. Any mild pure soap will make the skin clean and remove what is known as "body odor." After taking a bath a brisk rub with a rough towel will bring to the skin the warm healthy glow which is part of the enjoyment of taking a bath. You take a bath in private, but the clean rosy appearance of your skin lets the public know you have had one. The pleasant feeling of being clean and knowing that you look clean will not let *you* forget that you have had one.

"Now let anyone say my ears are not clean!"

From *All the Children*


19
20
21
22
WOWEE!

From *All the Children*

A manicure lesson

The Care of the Hands

The hands need special care because they are the parts of the body which most often come in direct contact with things in the outside world. Your hands should always be washed with soap and water before you eat or handle food, as this is one way of keeping harmful germs from entering the body through the mouth. It is also important to have clean hands because the hands are so noticeable. People look at them almost as much as they look at your face. It is best to wash the hands under running water if possible. They should first be thoroughly soaped, and then the soapsuds should be completely removed by rinsing. It is necessary to dry the hands thoroughly to prevent chapping. Only an individual towel should be used. Do you know why? If the hands chap easily in cold weather, a little plain cold cream or hand lotion rubbed in before going to bed will help to keep them soft and smooth.

The white part of the nail which extends beyond the pink nail bed readily picks up dirt and germs and must be cleaned out thoroughly each day if you are to have nice-looking hands. It is easier to manicure the nails just after the hands have been washed and the nails scrubbed with a nailbrush. Remove the dirt with the blunt tip of a nail file or with an orangewood stick and then trim the nails. It is better to trim the nails with a file than to cut them with scissors or a

knife. In filing the nails give the tips the shape that you prefer. A blunt orangewood stick may be used to push the skin back from the base of the nail. If this is done every day, hangnails are not so likely to form. If you do get a a hangnail, cut it away carefully with clean nail scissors. Picking at it, pulling it, or biting it may result in a serious infection. Like all other personal articles, the nail file, orangewood stick, and nailbrush should be used only by their owner. People with good manners usually manicure their nails in private and not in public places.

The toenails should be kept comfortably short. Cut them straight across in order to avoid ingrowing toenails. Use clean scissors and be careful not to cut the toes accidentally. If the toenails are smoothed off with a nail file after cutting, they are not so likely to "catch" on thin stockings and start "runs."

The Care of the Hair

Beautiful strong hair is largely a matter of good general health and cleanliness. The hair catches and holds more dust and dirt than any other part of the body, partly because it is oily and partly because the mass of hair acts as a net in which particles of dust and dirt and dead-skin scales get caught. The hair and scalp should be washed with warm water and soap at least once a week. The soap should be thoroughly rinsed out afterward. The

From *All the Children*

"Hands are always on parade"

act of washing the hair and scalp is called a shampoo. After the shampoo your brush and comb should also be washed, and dried in the sun. A little liquid ammonia added to the water will help to soak out the dirt.

Combing the hair and brushing it vigorously with a stiff-bristled brush night and morning help to keep the hair clean and orderly. Vigorous brushing also improves the circulation of blood in the scalp, removes dry-skin scales and loose hairs,—which might otherwise snow down on your coat collar and shoulders,—and makes the hair glossy by spreading the oil smoothly through the whole mass. Rubbing the scalp gently with the fingers also helps to improve the circulation and aids in removing loose scales of dead skin.

Have you ever heard it said that frequent washing with soap and water harms the hair by removing the natural oil? The oil glands in the scalp do not dry up when the hair is washed. There is a constant flow of oil from all the oil glands of the skin, including those of the scalp.

Perhaps you have also heard it said that singeing the hair makes it grow. But you have learned that the living part of the hair is buried in the skin. How can singeing the ends of the hair make the living roots grow? Some people think that the hair is hollow and that tonics rubbed in at the roots will rise up through the hollow hair and make it strong and healthy. But you know that the hair is built up of solid horny cells laid one above the other. In most cases it is the rubbing rather than the tonic which benefits the hair when a tonic is rubbed into the scalp.

From this you can see that a knowledge of physiology and anatomy is very helpful in deciding whether or not something will really make you healthier or better-looking when you are told that it will do so.

"Brushing the hair at night helps to make it look a
tractive in the morn

Steven A. Coo

ARE YOU DOING YOUR BEST TO HAVE AN ATTRACTIVE PERSONAL APPEARANCE?

Do you eat some fruit, a cooked green or yellow vegetable, a salad, milk, and an egg each day?

Do you take cod-liver oil in the wintertime and exercise outdoors in the sunshine on pleasant days all the year round?

Do you sleep ten or eleven hours each night?

Do you take an all-over bath with soap and warm water at least twice a week?

Do you change your underclothing and stockings frequently and always after an all-over bath?

Do you keep your outer clothing clean and neat and your shoes shined?

Do you keep your face, hands, neck, ears, and fingernails clean?

Do you shampoo your hair at least once a week and comb and brush it vigorously every day?

Are you doing your best to avoid skin troubles?

Do you use only your own brush, comb, and manicure articles?

Do you wear only your own hat and coat?

TRY THESE TESTS

1. Complete each sentence below by supplying a word or words from the box. (*Do not write in the book.*)

dermis	athlete's foot	complexion
pores	water	cells
washing	dandruff	soap
pediculosis	keratin	epidermis

a. The top layer of the skin is the __?__.
b. Hair and fingernails and toenails are composed of __?__.
c. The nerves and blood vessels in the skin are located in the __?__.
d. Hair grows out of the __?__ of the skin.
e. The openings of the sweat glands are called __?__.
f. Use of an antiseptic solution helps to prevent __?__.
g. The appearance of the skin is called the __?__.
h. Boys and girls should use only their own combs and brushes and wear only their own hats in order to avoid __?__ and __?__.
i. Frequent __?__ with __?__ and __?__ is the special service we do for the skin and hair.

2. Which of the following statements are true and which are false? Reword each false statement to make it true. (*Do not write in the book.*)

a. The color of the epidermis gives the skin its rosy appearance.
b. People with straight hair can make it curly by eating carrots.
c. The fingernails grow out of the cells of the skin.
d. Beauty is only skin deep.
e. Perspiration is the secretion of the sweat glands.
f. Blackheads may be removed by gentle pressure.
g. The hands are less likely to come in contact with dirt and germs than other parts of the body.
h. A beautiful complexion depends largely upon good health.
i. A swim is as good as a warm soapy bath for cleansing the skin.
j. In order to prevent chapping, the hands should be dried thoroughly after washing.
k. Biting the fingernails will keep the nails clean and smooth.
l. The hair should be shampooed at least once a week.

THINK ABOUT THESE QUESTIONS

Why is personal appearance important? Are you attracted more by a neatly dressed person than by one who is careless about his appearance? Look through one of the popular magazines and note the advertisements of soaps, tooth pastes, eyewashes, face creams, nail polish, beauty lotions, and shoe blacking. What appeal to the reader is made in these advertisements? It costs a great deal of money to advertise. Why do the advertisers think they will get their money's worth when they tell people that their product will give them a beautiful complexion or soft hands or white sparkling teeth or prettier fingernails? Do the advertisements give you some idea of the value placed by everyone on an attractive personal appearance?

DO THESE THINGS

1. If possible, examine your skin under a strong magnifying glass. Note the openings of the sweat glands. What are they called? Note the pits out of which the hairs rise. What is the name of the little ridges and valleys you see? Discuss in class the structure of the skin and how it acts as a protection against harmful germs.

2. Appoint different committees in the class to demonstrate to the class or to the children of lower grades proper methods of hand-washing, shampooing, and manicuring.

3. Have a Boy Scout or Girl Guide explain what he or she has learned about the care of the feet on a long hike.

4. Find out about the cleanliness customs of different peoples at different periods of history and of the inhabitants of various countries today. Discuss in class such questions as the following: How are the cleanliness habits and customs of people influenced by climate and ways of getting water? How have they changed in our country with developments in sanitation?

5. Find out what you can about the history of soap and soap-making from the earliest times to the present. From what different countries do soap-manufacturers get the ingredients for making various kinds of soap?

UNIT VII

Solving Problems

Man uses his brain in solving problems as they come along. As a result, he has developed his brain to the point where he can master his surroundings to suit himself.

DO YOU KNOW

What makes a problem?

What part of the body we use in solving problems?

The needs which all people have in common?

Why different people want different things?

What success is?

What a career is?

Which of these two girls most people like?

Why lying, stealing, cheating, and whining are not good methods to use in solving a problem?

How to accept defeat?

WHY WE HAVE PROBLEMS

It is fortunate for us that we do not need to concern ourselves with the internal affairs of the body. Just as long as we supply our bodies with what they need, the control of all the functions which keep us alive is managed by the involuntary nervous system. This leaves us free to deal with the outside world. Our relationship with the world around us is what determines our success or failure in life. This relationship, in turn, depends largely upon the sort of pathways we establish in the brain and spinal cord.

From the outside world everyone must get certain things in order to stay alive. We call these things needs. Food,

Boy Scouts getting better acquainted at a jamboree. Why are they swapping their possessions?

water, air, and shelter are needs which we all have in common. In addition to the things we need from the outside world, there are also things we want. Very few desires, or wants, are held in common. Each person wants different things at different times because each person is different from all other people. Because Tom is Tom and not Bill, he wants a bicycle at a certain time. Because Bill is Bill and not Tom, he wants a book on building ship models. Because Jane is Jane and not Alice, she wants a new red dress; and because Alice is Alice and not Jane, she wants a pair of roller skates.

What Is a Problem?

Our needs and our desires are what make our problems. If we never needed anything or desired anything, we should not have any problems at all. If we never needed to buy and sell or weigh and measure, for example, there would be no such thing as a problem in arithmetic. If we never needed food or shelter or clothing, fathers and mothers would not have to figure out ways to feed and dress their children, pay the rent, and buy fuel. If human beings were content to live without pleasure, ambition, or affection, then they would have no problems.

In solving a problem we use the thinking part of our brains. When we do this, pathways are formed in the brain as real as a telephone hookup, which makes it possible for two people far apart to listen to each other's voices. As a result of experience and training in dealing with problems we establish certain mental pathways which determine the ways in which we go about satisfying our needs and desires. Success in life depends very largely on forming the mental pathways which will help us to solve our problems in the right way.

What Is Success?

What do we mean by success? The word comes from a Latin word which means "that which comes after." Success is really a result. But a result of what? Let us see if we can find out. A small child is standing by a table on which a ball is lying. He wants the ball. He tries to reach it. At last he succeeds. Reaching the ball is "that which comes after"; it is the result of his efforts to obtain the object he wants. To be successful is to get what we want. The instant we realize this, we see how very important our wants are. We can want things which are good for us or bad for us. We can want things which hurt or help other people. Success makes us unhappy or happy according to the things we want.

Perhaps you have heard the story about the little boy who kept crying for something on the windowpane which his nurse would not allow him to have. At last his mother was so tired of hearing him cry that she told the nurse to let him have what he wanted. The next second the child gave a loud yell. The mother came running. The little boy had succeeded in getting what he wanted. It was a wasp! Can you think of things you have wanted which made you unhappy or ill when you got them? Can you think of things which made you or other people happy?

Acme

Why may a career in life be compared to running a race?

As we grow older, our thoughts and our dreams begin to run into each other to make one big want, just as tiny drops of quicksilver unite to form one large drop. This want is the desire of achievement. We wish to amount to something, to be somebody. It is a want, and perhaps the strongest want, which is common to all mankind.

You may have heard people talk about planning a career in life. What do they mean? What is a career? In ancient Rome a certain kind of wagon was called a *carrus*; and from that word the French made the word *carrière*, which means a track over which wagons are drawn in a race. A career is the track over which we run through life. But a race track is not a race track unless it has a goal, something for the runners to reach. So a career must have an object, or we should find ourselves running around in circles. Our main objects in life we call ambitions; they are the goals we want to reach. One of the very best things about being a human being is that we have brains, which enable us to see ahead to the goal we wish to reach and to plan how to reach it.

In making our plans, however, we must remember that there are certain things about ourselves which are beyond our control. Brown eyes can never become blue, nor straight hair naturally curly. Certain abilities can never be acquired, no matter how hard we try. On the other hand, we may have certain goals which seem almost impossible to reach but which can be reached. History is full of tales of men and women who have succeeded in doing what they had always dreamed of doing, although all the odds seemed against them.

In planning a career it is a good idea to talk over your abilities with an older person who knows you very well. In this way you may learn what you are best fitted to do. Your family doctor or your school doctor can also help you

Gendreau

A mother robin feeds her babies only until they are able to get food for themselves

to decide on a career. If you have some physical weakness which cannot be corrected, the doctor will help you to choose an occupation in which you can be successful. He may be able to remove or correct a physical defect which might otherwise interfere with what you wish to do.

DIFFERENT WAYS OF SOLVING PROBLEMS

The way in which we learn to solve problems when we are young largely determines the way in which we shall solve them when we are trying to reach the goal we have set for ourselves on the race track of life. There are a

great many ways of solving a problem. The best way is to solve it ourselves, if we possibly can. Many animals can do things for themselves as soon as they start life. Some of the lower animals, such as fish and insects, have no infancy. They are able to move from place to place and get their own food as soon as they are born. But all the more intelligent animals have a stage of babyhood, in which they learn how to take care of themselves. Parent birds, for example, feed the baby birds until their wings are strong enough for flying. Then, if they do not willingly jump out of their nest, the older birds push them out, and they are compelled to fly.

The parents of boys and girls do not usually push them out of the home when they are big and strong enough to earn their own livings. But most young people want to depend on themselves after they have finished their education. Even if they do not leave the home, they wish to contribute to its support and to earn their own spending money. But the biggest thrill of all comes when they make a home of their own. To prepare for the time when they must go forth to make their own careers, the boys and girls who are wise will try to depend on themselves as much as possible. Boys and girls who do this are called self-reliant.

Help in Solving Problems

Sometimes it is impossible to solve a problem without help. In talking about success we used as an illustration the child who finally succeeded in reaching a ball he wanted. Now suppose the ball is on a high shelf instead of on a table. The child cannot possibly reach it by himself. He must have help. His mother comes into the room. If he cries for the ball and his mother is trying to break him of crying for what he wants, he will not get the ball.

He will not succeed. But if he smiles and says, "Please," he will get it. He is learning that courtesy and cheerfulness will win the help of others when he cannot solve his problems without help. We all depend very largely on other people to help us to get our hearts' desires. Other people depend on us to help them to solve their problems.

Before reading further, close your eyes for a moment and make a picture in your mind of the sort of person you like. We describe the pictures we make in our minds with words. Would you use any of the following adjectives in describing the mind picture you have made of the sort of person you like: kind, courteous, honest, generous, self-reliant, industrious, self-controlled, modest, courageous, sportsmanlike, cheerful, clean? Are there any adjectives in this list which you would not use?

As you observe the likes and dislikes of the people around you, do you think that most people like the sort of person you like? Do you think the sort of person you like will be able to win the help of others in solving the problems he cannot solve by himself? Will the person you like be eager and ready to help other people to solve their problems? Check yourself against the picture you have made. Is it a picture of you?

Wrong Ways of Solving Problems

Perhaps you may have wondered why it is that some people seem to get what they want by doing things which we have been taught are wrong to do. Let us try to find out whether the people who use wrong methods of solving a problem are truly successful.

Whining, stealing, lying, and cheating seem to help

This boy's father cannot afford to hire a man to help him in the garden. How is the boy helpin to solve his father's proble

Steven A. Coons

some people to solve their problems. Why then is it not a good thing to whine and steal and lie and cheat? If such people lived as hermits do, away from all other people, they would have only themselves to cheat and lie to and steal from. They could harm only themselves. But since they live among other people, they make other people suffer. They become known as people who do not play fair. Most of us do not feel like helping the people who do not play fair. You have learned this yourself in playing games. It's no fun to play with someone who lies or cheats or whines or is not a "good sport." After a while you don't ask him to play. You don't like him. No one likes the people who do not play fair. When people are merely disagreeable or lazy or selfish or unreliable, society lets them alone to get through life as best they can. But when people do things which harm other people, such as stealing or murdering, society must punish these individuals in order to make them change their ways or to keep them from doing further harm.

Boys and girls who are always courteous and fair in work and play are more likely to find the right answers to their problems than are boys and girls who make other people suffer in order to get what they want.

Do You Know How to Learn from Failure?

We all meet defeat sometimes. It is impossible to work out every problem in mathematics correctly, to win every game, or to take the leading part in every activity. The wise person learns from his failures. When Peter the Great of Russia was defeated in one battle after another, he remarked cheerfully that, since his enemies fought so well, they would finally teach him how to beat them.

Some people fail in what they try to do because they do not plan how to spend their time. They try to do

in one hour what will require two hours. Others idle along and take two hours to do what they could have done easily in one, if they had put their minds on their work.

Some people try to do things for which they have neither the strength nor the training. As a result, they fail. If they keep on attempting the impossible, they acquire the habit of failure. But if they figure out why they failed in the first place and set about getting the strength and the skill they need, they may at last turn failure into success.

Nearly sixty years ago a German scientist named Robert Koch began to hunt for the germ that causes tuberculosis. Many men had been hunting for this germ, but they had failed. Koch also failed at first. One evening in 1882, after years of work, he performed his two hundred and seventy-first experiment. Then, bending over his microscope, he saw what no one had ever seen before—the tiny, rod-shaped germs which cause tuberculosis. He won success because after each failure he tried to find out why he had failed. As a result, he invented ways of studying germs that are used by other scientists to this day.

Many scientists today are working continually to find ways of curing certain diseases which still take the lives of thousands of people yearly. From their failures they hope finally to learn how to cure these diseases.

Steven A. Coons

This girl is helping her mother to solve the problem of having breakfast ready on time for a large family

ARE YOU DOING YOUR BEST TO FORM MENTAL HABITS WHICH WILL HELP YOU TO SUCCEED IN LIFE?

Are you trying to be the sort of person whom you like and whom other people like?

Do you try to do things for yourself as much as possible?

Do you try to help other people to solve their problems?

Do you plan your time so that you can do your very best in work and play?

When you fail, do you try to find out why, so that you can do better next time?

There are a great many different ways of solving problems. For example, take this problem of Bob's. Bob has a bicycle. Something is wrong with it. He has no money, and his father cannot afford to give him any. Here are some of the ways in which Bob may solve his problem:

a. He may cry and make such a fuss that his father at last gives him the money.

b. He may find out what is wrong with the bicycle and repair it himself.

c. He may earn the money to have it repaired.

d. He may take money from his mother's purse without her knowledge.

e. He may decide that he does not want a bicycle any longer and sell it or scrap it.

If Bob uses solution *a*, we call him babyish because crying is the method used by a baby to get what it wants. If he uses solutions *b* or *c*, we call him self-reliant because he depends on himself to get what he wants. If he uses solution *d*, he is dishonest. If he uses solution *e*, we may think he is easily discouraged; but if he is cheerful about giving up his bicycle, we think he is a "good sport."

Here are some other problems. Write down the possible solutions for each one. Then select an adjective which describes the person who uses each solution.

a. Nancy is going to a party, and she wants a new dress. Her mother cannot afford to buy it for her. What are some of the ways in which Nancy may solve her problem?

b. Bill has not studied his arithmetic lesson. When he reaches school, he finds that the teacher is going to give a written test. He sits next to the brightest boy in the class. What are some of the things Bill might do?

c. Jane has written a story. She thinks it is a pretty good story. She reads it to a friend. The friend finds fault with it. She tells Jane she should have done this or that and the story would have been much better. What are some of the things Jane might say to her friend?

d. John is captain of the baseball team. The team has won every

game of the season. In the last and most important game the team is beaten. What are some of the reasons John might give to the fellows in school when they ask him to explain why the team was defeated?

e. Joan is listening to her favorite radio program. Her mother calls to her to set the table. In what ways may Joan act?

f. Paul has an hour's ride on the bus to get to school. The bus is usually crowded when he gets on, and he has to stand fifteen or twenty minutes before he gets a seat. One morning an old lady with her arms full of bundles got on just after Paul had a chance to sit down. All the men in the bus seemed occupied with their papers. What are some of the things Paul might do?

THINK ABOUT THESE QUESTIONS

1. Do your parents have problems? Can you think of any? Is there any way in which you can help to solve them? Have you ever thought that your behaviour might sometimes be a problem to your parents? Can you help your parents to solve a problem of this kind? Try it out.

2. What are your problems at the present moment? Can you think of any ways in which they may be solved? In your opinion which of the solutions for your most difficult problem is the best? Test it and see if it works. If it does, can it be used to solve other similar problems?

DO THESE THINGS

1. Make a list of people who have been handicapped by a physical defect of some kind. How did these men succeed in spite of their handicaps? Examples are Demosthenes, a great orator of ancient Greece; Robert Louis Stevenson, a famous writer; Edward Livingston Trudeau, a beloved physician.

2. Make a plan for spending your time in the best way possible for one day. At what hour must you get up in order to wash and dress, eat a good breakfast, and get to school on time? How will you plan your free time in order to get outdoor exercise? What will you do after school? Shall you need to plan some time for study? When must you go to bed in order to get the amount of sleep you need?

3. The steps taken by a scientist in attacking a problem may be stated simply as follows:

a. Observing and collecting facts.
b. Guessing an answer that seems to fit all the facts.
c. Testing the guess by experiments.
d. Deciding whether the experiments have proved that the guess is the right answer.

In the following list you will find some famous problems that have been solved by scientists. The answers to these problems have made life safer for everyone. Divide the class into sections and have each section report to the class how the way in which the problem was solved illustrates the scientific method of solving problems, and what benefit the answer to the problem brought to the world.

a. Edward Jenner solved this problem: Does a mild disease of cows, called cowpox, protect people from the serious disease smallpox?
b. Louis Pasteur solved this problem: What is the cause of communicable disease?
c. Joseph Lister solved this problem: Why do wounds become infected?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words:

relationship	sportsmanlike
self-reliance	relaxation
self-controlled	pedestrian

subject (of an experiment)

2. Select, from the list above, the words which complete the following sentences. (*Do not write in the book.*)

a. The __?__ between brother and sister is very close.
b. It is __?__ to smile when one is defeated in a game.
c. A white rat was the __?__ of an experiment which was made to find out whether milk is important for growth.

3. Make up sentences using other words in the list above.

UNIT VIII

Safety through the Year

The people who depend on luck or any kind of magic to protect them from harm are people who wish to get something for nothing. Instead of expecting good luck or magic of any kind to protect them from harm, boys and girls today are learning that the best "charm" against accidents is their own skill.

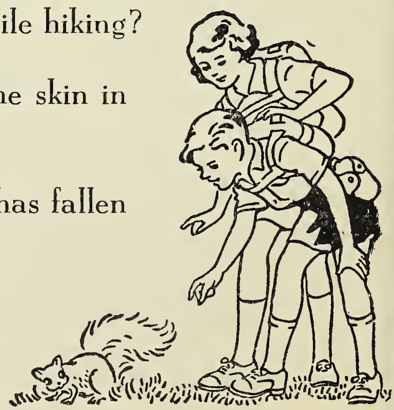
DO YOU KNOW

Which of these two types of accident causes the most injuries in the home?

What to do in case of fire in the home?

How to make school days safe days?

What precautions to take while hiking?



How a coat of tan protects the skin in summer?

How to rescue a person who has fallen through the ice?

How to make holiday celebrations safe as well as happy?

An analysis of all types of home accidents shows that by far the leading type is falls. Most falls can be avoided by the use of a little care.

Disorder is the principal cause of falls. By disorder is meant things out of place. If the soap, instead of being kept in its proper place, is left on the bottom of the bathtub or on the floor or on the stair treads, a person who steps on the soap and falls and breaks his arm or his leg or his neck may be said to have suffered injury or death because of disorder. Other examples of things which may be out of place and so cause falls are toys or other objects left on the floor or stairs; brooms, mops, pails, and other cleaning equipment left in dark hallways or on stair landings; electric-light cords stretched across parts of the floor where people walk; and furniture left out of place so that people may stumble over it.

Other conditions which may cause falls are slippery floors and small loose rugs which slide under the feet; soapsuds, water, or grease spilled on the floor; ice on walks or steps; torn carpets; loose or broken stair treads; shaky handrails; and poor lighting. Basement stairs are often the scene of falling accidents because they are likely to be poorly lighted. It is wise to have an electric-light switch both at the head and at the foot of all stairs. It is also a good plan to paint three or four white stripes on the last step of the basement stairs to make it clearly visible. A handrail is a further help.

Small rugs may be kept from skidding under the feet by putting nonslip pads under them. To prevent falls while getting in or out of the bathtub, a strong handhold should be fastened securely on the wall over the tub and a rubber mat placed in the bottom of the tub.

Good Housekeeping Institute

How is this girl helping to prevent falls in her home?

The personal factor most often involved in bad falls is standing on an insecure perch while trying to reach up to a high place. A rocking chair may be a comfortable safe seat in which to sit and knit or read, but it is a dangerous place on which to stand when one wishes to get something from a high shelf or to straighten a picture. The safe thing on which to stand in order to reach something otherwise out of reach is a strong stepladder.

The law of gravity dictates that not only do people themselves occasionally fall when they lose their balance or their perch but also that things will fall on them if not kept from doing so. Many people have been injured in the home by falling objects such as heavy books, dishes, jars of fruit, and other common household articles.

Sprains, Strains, and Bruises

Falling or stumbling may cause the ligaments surrounding a joint to be stretched suddenly or torn. This is called a sprain. There is pain and swelling, and the skin usually turns black and blue. A doctor should be called for a sprain unless it is very slight. The joint should be bandaged firmly so that the injured part cannot easily be moved. To relieve

the pain hot cloths may be applied. A sprained wrist or ankle may be put in a basin of hot water several times a day. The water should be kept as hot as the injured person can stand. A severe sprain requires a long period of rest. If a person whose ankle has been sprained tries to walk too soon the joint may always be weak and painful.

A strain is an injury to the muscles instead of to the ligaments. Rest, the application of hot water, and light rubbing are helpful in relieving the pain of a strain.

A bruise usually is caused by a fall or a blow. There is no break in the outside surface of the skin, but the capillaries in the lower layers are broken. Blood escaping from the injured capillaries and clotting in the skin tissues gives the black-and-blue appearance that we associate with a black eye or some other form of bruise. Cloth pads wrung out of cold water or cooled by placing on ice help to relieve the pain and swelling of a bruise.

Preventing Accidents Caused by Fire

Look at your watch or a clock for just one minute. During that minute a conflagration has broken out somewhere. The total loss by property damage from fire each year amounts to millions of dollars, and thousands of people lose their lives or are made homeless, for most fires occur in homes.

Here are some fire-prevention rules which all good homemakers should know and follow:

Have the soot cleaned out of stovepipes and chimneys from time to time, and repair all loose stovepipe joints and bad flues.

Shovel hot ashes from the furnace, stove, or fireplace into a metal container.

Burn paper and rubbish in a covered wire basket or incinerator.

Never hang curtains, towels, and other inflammable material near stoves, lamps, gas jets, or any open flame.

Use small electric-light bulbs on a Christmas tree instead of candles.

Make sure that matches and cigarettes and cigars are put out before they are thrown away.

Do not allow rubbish, oily or greasy rags, or stacks of old newspapers to accumulate. Spontaneous combustion may take place in such material.

Everyone should know what to do in case of fire. You have fire drills in school so that your response to a fire alarm is automatic. It is a good idea, also, to have fire drills in the home so that each member of the family will know how to escape from the building in case fire breaks out either in the daytime or at night. The first thing to do in case of fire is to send in an alarm to the fire department either by telephone or by running to the fire-alarm box nearest the home. Every home should have a fire-extinguisher and every person should know where it is kept and how to use it.

Remember that fire must have air in order to burn. Immediately close all doors and windows in a room where fire has broken out. If the fire is small and you can get near it, try to put it out by using a fire-extinguisher, water, blankets, or rugs. Do not use water on a fire caused by oil or gasoline, as the water will only scatter the flames. If your clothing catches fire, lie down and roll. Do not run. If you ever have occasion to escape from a burning building, remember that the air nearest the floor is usually the freest of smoke. Crawl out; do not walk. A damp towel or napkin held over the mouth and nose helps to strain the smoke. It is a good idea also to learn how to climb down a rope. In some schools boys and girls learn how to do this in the gymnasium. In case people are trapped in an upper

story of a burning home, a serviceable rope can be made by knotting bed sheets together and tying them firmly to a bedpost.

Burns and scalds are second in importance to falls as a cause of home accidents. It has been estimated that, in Canada, nearly three fourths of all fatal burns occur in home accidents.

Playing with matches left carelessly within reach of their prying fingers and playing about bonfires or near stoves or fireplaces are two of the chief causes of burns among little children. Most fatal scalds are caused by pulling over a pan, kettle, pot, or dish containing a hot liquid, or by falling into a tub or pail of hot water.

MAKING SCHOOL DAYS SAFE DAYS

The town of Springdale had a new school. On the day classes were first held in the new building Mr. Thomas, the chairman of the school board, made a speech.

"This school is now your school," he said. "The people who planned it and the people who built it have done everything possible to make the building and the playground pleasant, safe places in which to work and play. Now it is your turn. I hope you will all try very hard to make school days safe days in our town." The lesson of safety is an important one for you to learn.

When Mr. Thomas had gone, the principal of the school suggested that the boys and girls form a school safety council. As a result committees were formed from several grades to make up safety guides for different parts of the building and grounds. At the next assembly these committees made their reports. On the following pages are the safety guides which the committees made up and which all the boys and girls of the school were asked to follow.

Safety Guides for the Corridors and Stairways

Have traffic officers to keep order at the entrances and in the corridors at the times when a great many boys and girls are entering or leaving the building or passing from place to place in the building.

In walking through the corridors and up and down stairs, keep to the right just as automobiles do in the street. Keep going; gathering in crowds to talk things over holds up traffic. Walk; do not run or slide. Look where you are going.

Walk up and down the stairs one step at a time. Make sure that your shoelaces are tied so that you will not trip over them. A good thing for girls to remember is that high heels may cause a tumble in going up and down stairs.

Be careful not to spill water on the floor when using a drinking fountain and when washing your hands in the washroom. If you should accidentally spill water, wipe it up.

Attention.

Learn the location of all the doors leading out of the building, especially those nearest your classroom.

Corridors and stairs are not safe places in which to do stunts or to play tricks. Remember that the playground is the place for play.

In some schools boys of the Safety Patrol control traffic inside the school building

Safety Guides for the Classroom

Have a safety committee for each classroom. The members of this committee should be changed from week to week so that all the boys and girls in the class will have a chance to serve on it. Here are some of the ways in which the class may help the committee to make the classroom a safe place:

Keep the aisles, the doorways, and the fire-escape exit in each classroom free of things over which someone may stumble. When any article, such as a book, pencil, or blackboard eraser falls on the floor, pick it up at once. Keep your feet under your desk and not sprawled out into the aisles.

Always keep your coats, hats, sweaters, overshoes, and umbrellas in your cloakroom or locker.

Store tools and materials used in handwork in their proper places when you are not working with them.

Hold sharp-pointed objects, such as scissors, pencils, and pens with their points down. Look where you are going, and do not run when you are carrying any kind of sharp-pointed article.

Try to remember to keep things out of your mouth that do not belong there. This means that you should not lick or chew pencil points or hold pins, beads, pen points, coins, or any other object in your mouth.

Do not open a door in a hurry or slam it shut, as you may hit someone on the other side. In opening swing doors, push on the "push" plate. Never push or lean against a door or a window.

As cloths soaked with oil or turpentine and stacks of newspapers catch fire easily, these articles should not be left in the classroom.

Keep desk drawers closed. Do not keep so many things in your desk that you cannot close the drawers tightly.

Have safety officers on the playground as well as in the school building; but everyone, even the youngest children, should feel responsible for keeping the playground in a safe condition.

Anyone who sees anything on the ground which may cause an accident should pick it up. Objects such as glass, nails, sharp-pointed sticks or stones, and fruit peelings, and all other rubbish should be picked up and placed in the rubbish containers on the playground. Good citizens will also remove such things as papers or eggshells that give the playground an untidy appearance even if they are not really dangerous.

Committees of older boys and girls should daily test the swings, teeterboards, slides, and giant strides used by the younger children and report promptly any piece of apparatus that needs repair. The children should not be allowed to use broken apparatus until it has been mended.

Older boys and girls should always test playground apparatus before using it themselves.

Vigorous running games, such as baseball or football, should be played at a safe distance from groups of small children. Boys and girls watching the game should keep out of the way of the players.

Snowball fights, the throwing of sand, stones or sticks, and the use of peashooters, slingshots, bows and arrows, air rifles and other toy weapons should all be forbidden on a crowded playground. A part of the playground far away from the school building may be set aside for snowballing after a snowfall.

Climbing is lots of fun for those who have learned to do it skilfully, but it is not fair to climb things on school property which were not meant to be climbed. You may

damage something or hurt yourself and cause other people a lot of trouble for something which was not their fault.

SAFETY OUT OF DOORS

If you expect to hike or to camp in country where there are poisonous snakes, find out what these snakes look like and what their habits are, so that you will know what to do to protect yourself.

Poison ivy. Do you know it when you see it growing?

The victim of a snake bite ought to have treatment by a doctor as soon as possible. If a doctor cannot get to the victim quickly, the victim must be carried to a doctor's office or to a hospital. He should not be allowed to walk, as exercise helps to spread the snake venom, or poison, through the body more quickly. The poisonous effects of certain kinds of snake venom may be counteracted by antivenom serum if a doctor is able to give it to the victim soon enough.

Mosquito netting to be used as a protection against insects, especially at night, should be in every camper's kit. Never scratch an insect bite, as this makes it worse and may lead to infection. Dab a little iodine or some other

antiseptic on the sting, and to relieve the itching apply a paste of baking soda and water.

Everyone who lives in the country or goes there on a vacation should be able to recognize poison ivy and other poisonous plants. Poison ivy has dark shiny green leaves arranged in groups of three. It has a greenish flower, and later in the season it has clusters of waxy white berries.

After a hike or a picnic in the woods or fields, always wash thoroughly with laundry soap and warm water, as you cannot be sure that you have not touched poison ivy. Small blisters on the skin and severe itching are the first signs of ivy poisoning. Washing the poisoned area with a weak solution of a medicine called potassium permanganate is the treatment usually recommended. A dressing kept wet with a strong solution of baking soda may relieve the itching. A severe case of ivy poisoning should always be treated by a doctor.

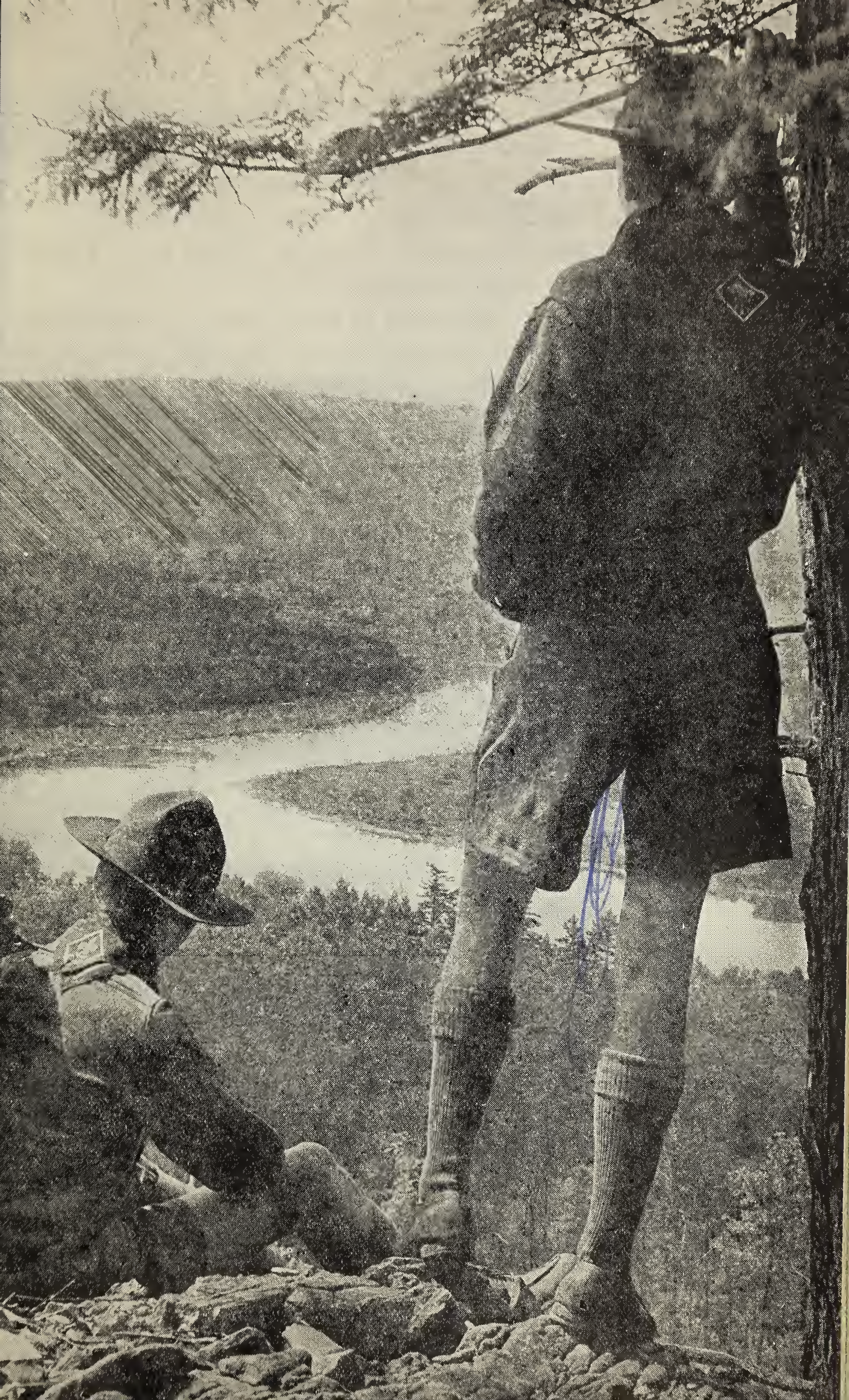
On hiking or exploring trips either in the country or the city, there are certain precautions to take if you are to come back with only pleasant memories. First have consideration for your feet. Wear comfortable low-heeled shoes and clean stockings. On a long hike heavy shoes and stockings will help to prevent blisters.

The party should walk in single file along a highway and keep to the left, facing traffic. If it is necessary to walk on a highway after dark, carry a light or wear something white.

In strange country the party should keep together. Elect a leader and obey his orders. Arrange beforehand what sort of signs are to be left along the trail for anyone who may get lost. These signs may be piles of stones or twigs arranged in a certain way.

Do not drink water from pools, brooks, or springs unless the source of the water

"Time out to rest and to enjoy the scen



is marked "pure drinking water" by the department of health. If you are in doubt about the purity of drinking water, boil it for five minutes.

On a long hike do not try to walk too fast or too far. Plan rest periods and use them for resting even if you do not feel tired at the moment.

Learn to recognize and to avoid places that are unsafe to explore. A cave or a pit may "cave in" on top of its explorers. Cliffs along rivers and lakes, high trees, bridges, and railroad trestles are dangerous places for climbing. Old deserted buildings, buildings under construction, and country barns are unsafe places to explore unless you are with someone who is familiar with the place visited.

Avoid petting or disturbing strange animals. As some farm animals are dangerous, stay away from them unless you know they are gentle. In case you are bitten by an animal flush the wound under running water to remove the animal's saliva and go at once to a doctor.

Sun and Water

The sun is one of our best friends all through the year. But in the late spring and summer we get more good from the sun than at any other time. This is because more ultraviolet rays reach us from the sun in summer than in the fall or winter. You have learned that these rays falling on the bare skin help the body to manufacture vitamin D. As summer clothes, especially play clothes and bathing suits, leave more of the skin bare than winter clothes, and as people like to spend as much time as possible out of doors in warm weather, summer is the "busy season" in the "factory" of the skin where vitamin D is made.

There is one danger which must be guarded against in

this manufacturing process. Too much sunshine causes sunburn. A bad sunburn is as painful and may be as dangerous as a burn caused by contact with fire or a scalding liquid or a hot stove. You may avoid sunburn by getting used to the hot summer sun gradually. Let the sun shine on your bare skin for a little time each day until you acquire a coat of tan. Tan acts as a screen to protect the skin from sunburn.

If it is necessary for you to be out in the summer sun for any length of time before you have gained a protective coat of tan, wear a wide-brimmed hat and cover with olive oil or cocoa butter the parts of your skin not covered with clothing.

In the treatment of sunburn any clean oil or burn ointment will give relief if the skin is not broken. If the skin is raw and blistered, a dressing of sterile gauze moistened with a solution of baking soda and water should be put on.

Sunstroke may result if a person stays for too long a time in the hot sun. A person suffering from sunstroke nearly always becomes unconscious. His skin is dry and hot and his face flushed or red. Remove the victim to the coolest place possible and send for a doctor. Then lay the patient on his back with his shoulders raised, put ice or cold wet cloths on his head, and sponge his body with cool water or wrap him in a cool wet sheet. Further treatment will be prescribed by the doctor.

Safety in and on the Water

Swimming is good fun and good exercise, and the ability to swim skilfully may prove very useful to the swimmer himself or to someone who needs help in case of an accident. One of the marks of a good swimmer is that he never takes chances in the water. Even though he can "swim

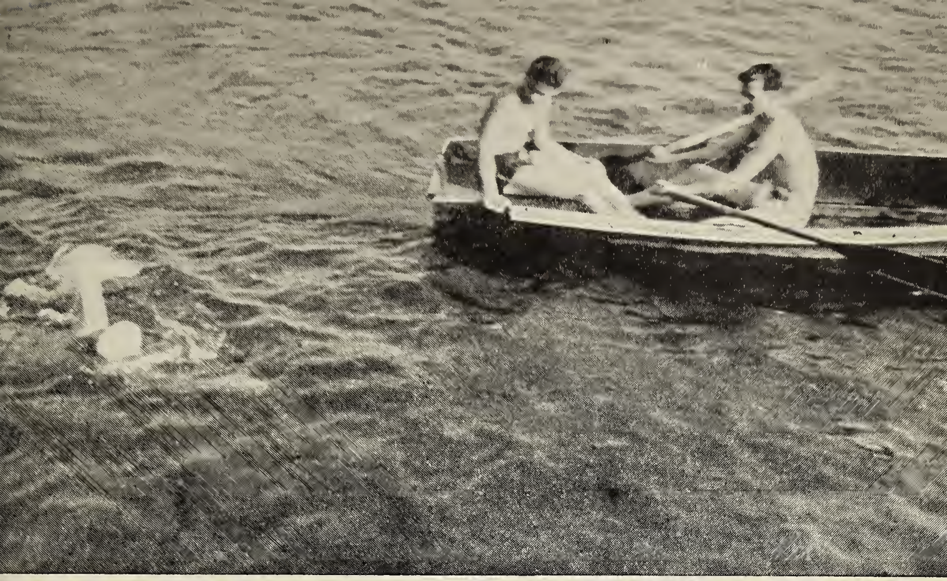
like a fish," he knows that he does not breathe like a fish. If for any reason it were impossible for him to come up for air while he was below the surface of the water he would drown as surely as a fish out of water would die.

If you are learning to swim, stay in shallow water. It takes just as much skill to swim in water four or five feet deep as in water four hundred feet deep. The only difference is that if you get tired in water four or five feet deep you can stand on solid ground and keep your head above water.

Even if you are a good swimmer, do not go swimming in an unfamiliar body of water without investigating it beforehand. Hidden rocks, strong currents, masses of strong-stemmed, slippery water plants growing below the surface of the water are some of the dangers to guard against. It is especially important not to dive into water unless you are sure of its depth. Remember that a dive should never be attempted in water less than six feet deep. Always examine the diving place for underwater rocks or logs before jumping in. Never dive after dark, even in a familiar swimming pool, unless it is brightly lighted. Many serious accidents have occurred at night from diving into partly drained or dry swimming pools.

Never go swimming alone. If you get so tired on dry land that your legs will no longer carry you, you can sit down and rest. If you become exhausted in the water, you may not be able to get to land unless there is someone at hand to help you or to call for help. Never go on a long swim in deep water unless two people go with you in a boat—one to row and one to keep his eyes on you.

It is possible for even the most skilful swimmer to get a cramp. Cramps in the stomach may make it impossible for a swimmer to help himself in any way. Swimming after eating a hearty meal may cause cramps in the stomach.



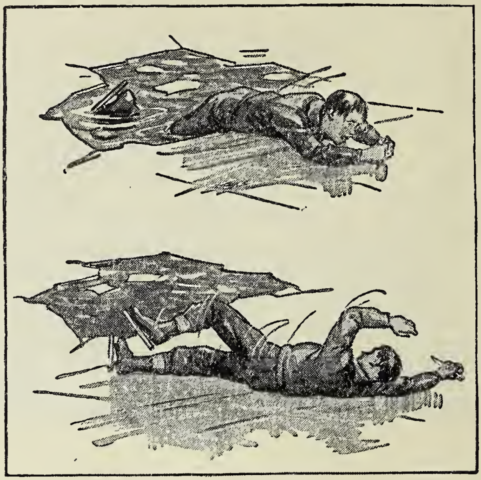
Three on a long-distance swim—one to swim,
one to row the boat, and one to keep his eyes on the swimmer

What to Do in Case of an Ice Accident

A person who has broken through the ice should call loudly for help and at the same time extend both arms on the surface of the ice and kick his legs as if swimming the crawl stroke. This will keep him from getting too cold and will allow the water to support part of the weight of his body. If he tries to climb straight up out of the hole, his full weight will probably continue to break the thin ice at the edges. Lying flat he should crawl forward on his stomach until his hips are at the edge of the hole. He should then extend his arms above his head, and roll away from the broken edge. He can more easily pull himself out if he has a sharp object, such as a knife, with which to obtain purchase on the ice.

After getting out of the water, the victim of the acci-

dent should continue to crawl until he is at some distance from the hole. Thin ice will better support body weight when it is spread out, as in crawling, than when it is centred on a small area, as in standing up.



Study this drawing as you read about what a person should do if he has fallen through the ice

In going to the rescue of someone who has broken through the ice, the rescuer should crawl, not walk or skate. He may shove a pole or a plank to the edge of the hole so that the victim may distribute his weight on it while climbing out. Or the rescuer may throw a rope to the victim. A knot or small stick tied in the end of the rope will enable the victim to hang on to it while he is being pulled out. If no other means of rescue are at hand, a group of skaters may make a human chain to the victim. Members of the chain crawl forward on their stomachs, each one holding with one hand to the skate of the person ahead and with the other pulling himself forward. The shore members of the chain kneel or stand and pull as the chain moves backward.

After the rescue the victim should be wrapped up warmly and taken indoors as quickly as possible. If he is not breathing, he must be given artificial respiration at once. A doctor should always be called to treat the victim.

Keystone

After a heavy snowfall.
What sort of accident is this person helping to prevent?

Fun in the Snow

Both for coasting and for skiing, choose slopes where you will not have to keep a constant lookout for passing automobiles. Inspect slopes which you have not used before for tree stumps buried in the snow, hidden rocks, and dangers at the bottom, such as crossroads, stone walls, open water, and trolley-car or railroad tracks. If you are just learning to ski, leave the heel straps of the skis open so that you can slip out of them easily. Do not carry your ski poles across the front of your body.

For snowball fights use only soft snowballs, and even then do not aim at the players' faces. It is not fair to throw snowballs at passers-by who are not on the lookout for them. Throwing a snowball at the driver of an automobile may cause a bad accident.

People who stay out of doors for a long time in bitter cold weather may get frostbite. As soon as a person with frostbite has come indoors the frozen parts should be bathed with warm, not hot, water. This will cause gradual thawing rather than sudden thawing. Rub the frostbitten places very gently, as it is easy to injure frozen tissues. If you are a victim of frostbite and cannot immediately find shelter, cover the frozen part with clothing or with a warm hand or other warm body surface.

CELEBRATING HOLIDAYS SAFELY

Every nation has great anniversaries to remember with rejoicing. Some days, like Christmas and New Year's and Easter, are days of rejoicing in many different countries.

Each day that we celebrate for some special reason has its own customs. Many of these old customs are appropriate and beautiful. But no customs are worth preserving if they are dangerous.

Patriotic Celebrations

In many countries it is the custom to shoot off fireworks to celebrate the anniversaries of great events. Hundreds of people have been killed or badly burned, crippled, or blinded by setting off fireworks.

Many communities now have laws which forbid or limit the sale of fireworks. But it is hard to enforce such laws unless all the citizens do their part. Parents living in a place where the sale of fireworks is forbidden may heed the pleas of their children for firecrackers, torpedoes, and

other toy explosives and go by automobile to some other town to buy them, thus evading the law.

Older boys and girls may help their parents to do their share as good citizens in making the celebration of patriotic holidays safe as well as joyful. Do not buy fireworks yourself or ask anyone to buy them for you or let little children handle them. Help to spread the idea of community celebrations of patriotic holidays. Some towns and cities plan an all-day program of games and sports, with fireworks set off in the evening by men trained to handle them. Then people may enjoy watching fireworks without the danger of losing "in the twinkling of an eye" the sight of an eye forever.

Automobile accidents and drownings take even more lives than do fireworks on patriotic holidays. In planning a picnic or an automobile ride or some other outing on such days it is best to avoid places where you know there will be big crowds and heavy motor traffic.

A Safe and Merry Christmas

Early Christmas morning each member of the family tries to be the first one to say "Merry Christmas" to the others. The customs and sights and sounds, even the smells, of the Christmas season are so jolly and gay that *merry* is a good adjective to put in front of *Christmas*. Another good adjective to put in front of it is *safe*. Making Christmas a safe time is one of the ways in which we may keep it from being a sad time instead of a merry time. Here are some suggestions for a safe Christmas.

Choose decorations for the home and the tree that will not burn. A sparkling substance, called mica, and asbestos cotton will make pretty snow effects. Ornaments that will not burn are easy to obtain and are as pretty as the ones

that will burn. Use small electric-light bulbs instead of candles on the tree and in the windows. Fix the tree firmly so that it will not be knocked over by people moving about the room. Never place a Christmas tree near a stove or fireplace.

A Safe and Jolly Halloween

Superstitious people used to believe that on Halloween witches and their black cats rode through the air on broomsticks, naughty elves played pranks on human beings and animals, and the future might be foretold in a number of ways. Many Halloween customs have come down to us from olden days. Among these is the playing of tricks. There are just two kinds of tricks—one kind is good and the other is bad. A good trick is one that everyone enjoys. A bad trick is one that is dangerous or frightening or costly to the person on whom it is played. Some boys and girls think it is fun to destroy property on Halloween or to scare little children and old people. They think they can "take time off" just for one night from being good citizens. What should we think of the citizen who decided it was all right to be a thief or a destroyer of life or property one night a year?

There are many ways of having fun on Halloween without playing dangerous pranks. Plan your celebration so that everyone will have fun and not just some.

Roberts

Have you ever tried to do this at a Halloween party?

ARE YOU DOING YOUR BEST TO PLAY AND WORK SAFELY?

What do you do to make your home a safe place?

Are you helping to make school a safe place by following the safety guides for the corridors, the classroom, and the playground?

Do you stay away from places that may be dangerous to play in or to explore?

Do you get used to the rays of the summer sun gradually?

Do you know and follow the precautions that help to keep you safe in the water?

Do you know and follow the precautions that help to keep you safe while skating?

Do you coast or ski only on slopes that you know are safe?

Do you refrain from throwing hard snowballs at anyone?

Do you keep the steps and sidewalks about your home free of ice and snow in the wintertime?

Do you help all you can to make the celebration of all holidays safe for everyone?

1. Look up the meaning of the word *sportsmanship.* Which of the following practices are good sportsmanship? Which are poor sportsmanship? Give the reasons for your choices. (*Do not write in the book.*)

a. Keeping one's belongings in their proper places at home.
b. Ringing a false fire alarm.
c. Playing with a fire-extinguisher.
d. Running or shoving in the corridors at school.
e. Going up or down stairs two steps at a time.
f. Picking up things from the floor of the classroom.
g. Picking up nails or bits of glass from the school playground.
h. Teasing younger children on the playground.
i. Climbing fences or walls on school property.
j. Coasting down a city street not set aside for coasting.
k. Throwing snowballs at passers-by.
l. Having a boat accompany you on a long-distance swim.
m. Destroying property on Halloween.
n. Avoiding the use of fireworks.

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. The principal mechanical factor in falls is disorder.
b. In case one's clothing catches fire, the best thing to do is to run for help.
c. Poison-ivy leaves are arranged in clusters of three.
d. Tidiness makes for safety at school as well as at home.
e. Safety at school concerns only the principal.
f. Toy weapons have no place on the playground.
g. Water is safe to drink if it looks clean.
h. On a hiking trip it is good practice to elect a leader.
i. In walking along the highway, we should keep to the right.
j. It is not likely that a good swimmer will get cramps.
k. A frozen part should not be rubbed with snow.
l. A good citizen makes safety a habit.

THINK ABOUT THESE QUESTIONS

What would you do if—

a. Someone with whom you were hiking were bitten by a snake?
b. You got lost from your party while hiking in the woods?
c. You knew you had touched poison ivy?
d. You were stung by a bee?
e. You got a cramp in your leg while swimming?
f. You saw someone drowning and there was a boat near by?
g. You fell through the ice?
h. You saw another skater fall through the ice?
i. Someone sought shelter in your home because of frostbite?
j. A young child asked you to buy firecrackers for him?
k. You wished to place a star at the top of a Christmas tree?
l. You were with some boys and girls who wished to break windows as a Halloween prank?

DO THESE THINGS

1. As a class activity, prepare an exhibit on vacation safety and invite the other grades in the school to see it. The following items may be included in the exhibit:

a. A large map of the neighborhood, on which is shown the location of playgrounds, protected swimming places, places where swimming lessons are given, museums, libraries, parks, and other safe places for play and recreation.

b. Examples of the hobbies of various members of the class, with a list of other hobbies and how to start them.

c. Examples of books suitable for boys and girls of various ages, with reading lists giving the names of other books for each age group.

d. Pictures of poisonous snakes and poisonous plants with suggestions for protecting oneself against such dangers.

e. A first-aid kit to be taken on a hike or camping trip, with directions for using it.

f. A safety pledge for swimmers written, hand-printed, and illustrated by the class.

2. Have each member of the class make a list of all the safe places for coasting, skating, and skiing in his or her neighborhood. From these lists make a winter safety map and place it where it may be consulted by all the boys and girls in the school.

3. Plan for the following demonstrations in class:

a. How to treat someone who has touched poison ivy or other poisonous plant.

b. Rescue of someone who has fallen through the ice.

c. A good Halloween stunt.

d. How to treat someone who has had a sunstroke.

e. How to treat someone who has had frostbite.

4. Look up the regulations in your community concerning the use and sale of fireworks. Find out how many people were killed and injured by fireworks last year in Canada. Discuss in class ways in which you may influence others to celebrate patriotic holidays in a safe way.

5. Choose either Christmas or Halloween and find out the origin of some of the customs observed on that day. How may the customs you have investigated be observed safely?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or terms:

venom	appropriate
antivenom serum	mica
counteract	anniversary
vacationist	observe a custom
potassium permanganate	

2. From the four words following each of the words given first in the list below choose one similar to it in meaning:

a. venom: *hatred, poison, wickedness, medicine.*

b. anti (as a prefix): *with, for, to, against.*

c. counter (as a prefix): *opposite, before, together, again.*

d. frantic: *calm, joyful, brave, crazy.*

e. appropriate: *good, suitable, pleasant, unfit.*

UNIT IX

A Healthful Community Life

Very few people live by themselves. Even in rural districts where homes are scattered people live and work and play together. To be a member of a group brings many privileges, but it also brings many responsibilities. This is particularly true of the control of disease. So many factors in the home and community enter into the problem of keeping well that we must work together in dealing with them.

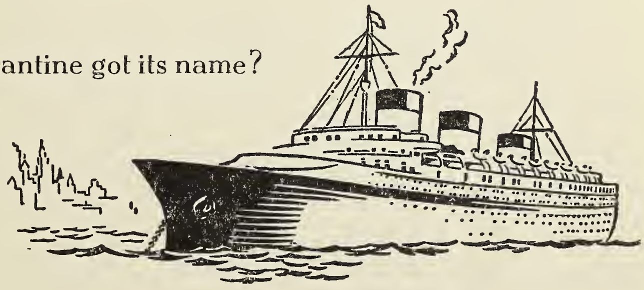
DO YOU KNOW

What is meant by a medical health officer?

How to figure the birth and death rate of a community?

What is meant by a communicable disease?

How quarantine got its name?



The name of one of the first books to be printed?

What is meant by a Union Hospital?

It is human nature to accept without question the blessings of life by which we are surrounded. If we pause to consider it, we must acknowledge that we, today, enjoy health privileges and a freedom from health hazards which our grandparents would have thought to be little short of miraculous. Remember that none of these health miracles have come without great effort on the part of someone. Through the years devoted men and women have searched and studied and suffered—some have died—that those who came after them might be strong and well and free from the crippling effects of disease and ill-health. It is the same today. Our scientists and doctors work unceasingly to discover the cause of disease and to develop ways and means through which protection may be made possible. No doubt it will always be the same. Some student now in your own school may become a research worker whose discoveries will benefit all mankind just as those of Pasteur, Lister, Banting, and the rest are doing today.

Public-Health Departments

It has been found wise in Canada to develop a department of government in provinces, cities, towns, and rural areas which will be responsible for maintaining public health. In certain matters, the Department of Pensions and National Health at Ottawa accepts this responsibility.

Every province has a public-health department with a Minister and a Deputy Minister in charge. Sanitation, vital statistics, communicable disease, public-health nursing, and hospital administration are some of the interests of the health departments of the provinces. Cities have city health departments or boards, while towns, villages, and rural areas have committees which carry on the work.

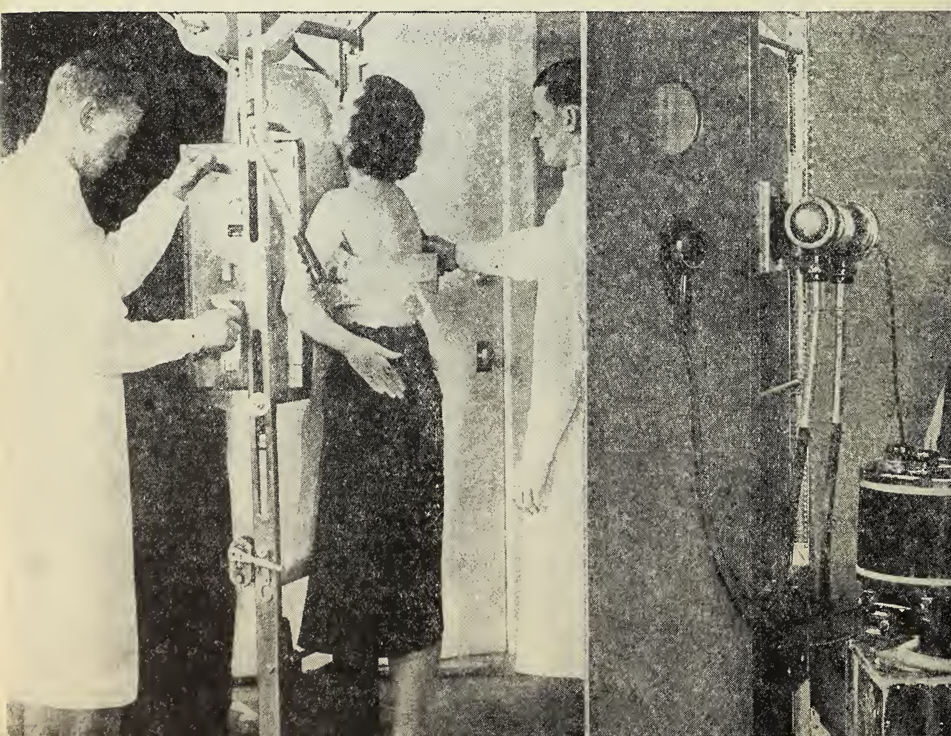
Health laws are made by the Dominion and provincial governments, but the smaller bodies pass by-laws for carrying them out. While education is certainly the best means of assuring public acceptance of health laws, it has been found advisable to put "teeth" into them as well. By this we mean that people who do not obey the laws are fined, or even put in prison. This is necessary because so many persons may be affected by another's ignorance or indifference. Health laws are important in order that people may live together healthfully.

The medical health officer is the person in charge of health work in a district. His duties concern the safeguarding of the health of the people in his community in every way known to medical science. He must have a record of all the diseases, when they occur, where, and, in many cases, why. From this he plans for health protection and for health education. Few, if any, rural communities have a full-time medical health officer. This has always been a worry for health departments. In recent years a system of health units has been started which is intended to meet this need. Under this plan, several counties or municipalities combine to establish a complete health office such as we have in cities. Located in a central town and staffed with a medical health officer, public-health nurse, sanitation inspector, and laboratory worker, the activities are carried to all parts of the district or unit. It is an excellent plan, and health units are now found in all parts of Canada and the United States. The Province of Quebec is very well organized and has a greater number of health units than any other province.

However, the very best health department cannot be entirely successful without the help of every one of us. What part must we play? The answer to this question is simple. The first responsibility of every individual is his

own health. Regardless of community health measures and scientific discoveries, personal health can be maintained only by the regular application of health principles by each one of us. Too much emphasis cannot be placed on health practice, on regular medical and dental examinations, and on the early treatment of even minor ailments. It is a good plan to go once a year to your family doctor for a complete physical examination. Some people choose their birthday for this visit. This is a good idea, indeed, since they are less likely to forget or neglect it than they might be if they set no definite date. Such an examination reveals the beginning of any disease or physical defect. Treatment, then, is less costly and more effective. All public-health agencies urge this yearly examination, both for young and old. Life insurance companies consider it so important that they provide periodical health examinations free, for certain policyholders.

By taking an X ray picture of the lungs a doctor finds out whether or not a person has active tuberculosis



Expectation of Life

Did you ever have a palmist "read your hand"? Sometimes at fairs we see gypsies or strangely dressed persons who claim to be able to tell the future from the lines in the palm of the hand. One of these lines is called the life line. It is always of interest, and one of the first questions is, "How long am I going to live? Will my life be long or short?" You can judge for yourself whether or not the answer can truthfully be read from the palm!

Interest in the length or span of life is quite natural and general. By "span" we mean the time between birth and death. It is impossible, of course, to say for any of us just how long the span will be. We can, however, tell how long a baby born today may be expected to live. We know this from the average taken from records of births and deaths and causes of deaths which are kept by the vital-statistics divisions of public-health departments all over the world. We speak of it as "life expectation." Life expectation now is 61 years. That is, a child born today may be expected to live to be 61 years old. Not every child born this year will live for that number of years, and many will live much longer; but the average will be 61. Forty years ago, the life expectation was only 49 years. How has this length of the span been increased by 12 years in so brief a period of time? It has been done by the application of scientific discoveries regarding health. This has resulted in safer surroundings, more protection against disease, and more general translation of health knowledge into health practice.

It is important in planning health activities that boards of health have records of vital statistics, that is, they must know the birth rate and death rate. If the death rate is high for a particular disease, then health departments double their efforts to attempt to reduce it.

The method of computing birth and death rates is interesting. The general rate is worked out at so many per thousand of the population. It is computed by dividing the number of babies born alive or the number of persons who died by the total population at the middle of the year and multiplying the result by 1000. Thus:

$$\text{General birth rate per thousand} = \frac{\text{Number of births}}{\text{Population}} \times 1000$$

$$\text{General death rate per thousand} = \frac{\text{Number of deaths}}{\text{Population}} \times 1000$$

For example, in Saskatchewan in 1939 the number of babies born alive was 18,059 and the estimated population on July 1 was 949,000. Thus:

General birth rate for Saskatchewan in 1939 =

$$\frac{18{,}059}{949{,}000} \times 1000 = 19.0$$

See if you can find out the number of births and deaths and the population for your own locality. Work out the rates and consider if something might have been done to prevent some of the deaths.

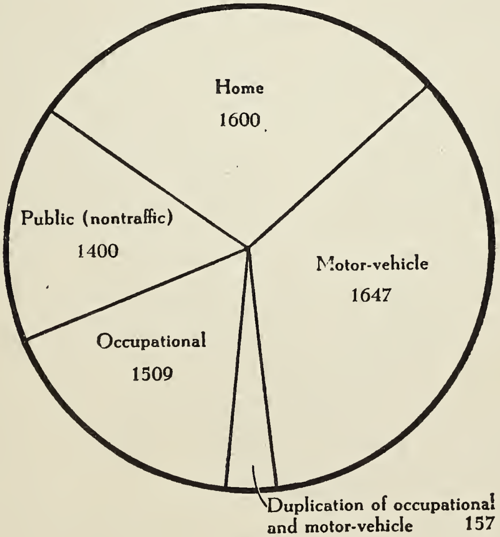
PREVENTING COMMUNICABLE DISEASES

One of the common causes of illness and death among children has always been the diseases which are known as infectious or contagious or, more commonly in recent years, as communicable. They are the "germ" diseases which one person may "catch" from another. Until the time of the great Pasteur, no one had the faintest idea how to save children from the terrible epidemics of diphtheria and scarlet fever which swept the country from time to time. Nowadays, no child need suffer from smallpox, diphtheria, or scarlet fever because medical science has provided the

means of prevention. Soon, we hope, we may be able to say the same of whooping cough, measles, and other diseases.

When cases of a communicable disease occur in a community, they must be reported to the medical health officer and he is responsible for their isolation, or quarantine. These may be new words to you, so it would be wise for us to try to find where they came from and what their meaning is. It is said that the word *quarantine* was invented in Italy in the fourteenth century. Ships coming into port were suspected of bringing cases of a very terrible disease known as the Black Death. The people of Venice decided that no person should be allowed to land from a ship until it had been in the harbour for forty days. They thought all the sick people would be well in that time. The Italian word for forty is *quaranta*. So we get the word which means

Find the number of people who lost their lives in accidents in Canada in 1941, by adding the figures in the four large sectors and subtracting 157 from the total. The figure 157 is the number of people killed in motor vehicles while at work and is reported under motor-vehicle accidents as well as under occupational accidents



that persons ill with certain diseases cannot be near other people until they are well. When a house is quarantined, no person may leave it and no person may enter until the medical health officer gives permission. Probably you have seen the card which is tacked on the door so that everyone may be warned.

"Isolation" means keeping the sick person by himself until he is no longer a danger to other people. For instance, if the medical health officer approves, a child with mumps may be kept in his own room, away from the other members of the family, except the one looking after him. The other persons in the house may go in and out of the house but must not enter the sickroom. So he is isolated from the others. Quarantine and isolation are means of preventing the spread of a disease by keeping others away from the sick person. The number of days for each disease is set by law. It is important that quarantine and isolation are not broken by indifferent and foolish people. Only the medical health officer is qualified to say when isolation or quarantine should be over.

The communicable-disease divisions of public-health departments do a vast amount of work. Vaccines and serums are provided free to doctors and hospitals for protection or immunization against diphtheria, smallpox, scarlet fever, typhoid fever, whooping cough, and other diseases. Many parents have this immunization carried out by their family doctor. School boards and city health departments often co-operate to have the work done by doctors and nurses at the school. This is a very good plan, indeed, and thousands of children throughout Canada are protected every year right in their own school. Where districts are remote from doctors, the public-health nurse makes arrangements for a doctor to pay a special visit. Frequently the cost is borne by the provincial health department.

In the city of Venice six hundred years ago the wo
quarantine was invent

Have you read *Microbe Hunters*, by Paul De Kruif, or *Health through the Ages*, by Grace T. Hallock and Dr. C. E. A. Winslow? If so, you must have noticed the very close connection between good sanitation and a healthful community. Many of the great health discoveries have grown out of studies and experiments in connection with the surroundings of our homes. Even in the days of the early Romans it was considered to be an important subject. We read that in 97 A.D. Sextus Julius Frontinus wrote a book called *The Water Supply of Rome*. This was so highly regarded that it was kept very carefully, and when printing was invented it was one of the first books to be printed. Today we count safe milk, safe water, safe food, and safe disposal of wastes as health essentials. No community can keep its people well without providing for these.

Every modern health department has its sanitation code and an active section on sanitation. Inspectors from this section work closely with the local boards of health to advise and assist in the installation of sewage plants and public water systems. In rural areas the inspectors make regular visits to check on wells, toilets, dairies, and slaughterhouses. Water and milk samples are analyzed at regular intervals. Residents of both rural and urban areas may have water examined by the authorities without charge.

If you have read of the work of Sir Ronald Ross and Walter Reed, you realize the danger of flies, mosquitoes, fleas, rats, lice, bedbugs, and cockroaches as disease-carriers. The destruction of their breeding places and their eradication from human dwelling places are an ever-present problem. Community cleanliness, both inside and outside homes, barns, and buildings, drainage of stagnant water pools and removal of all wastes are some of the means em-

Acme

Burning rubbish and garbage in a public incinerator plant

ployed. Constant and persistent effort is needed. The all too common housefly in his journeying from unscreened outdoor toilets to the food spread for little children may do more harm than can ever be undone. "Swat the Fly" is a fine slogan, but "Destroy him and all other insect and animal disease-carriers before they have a chance to live" is a much better and more economical one.

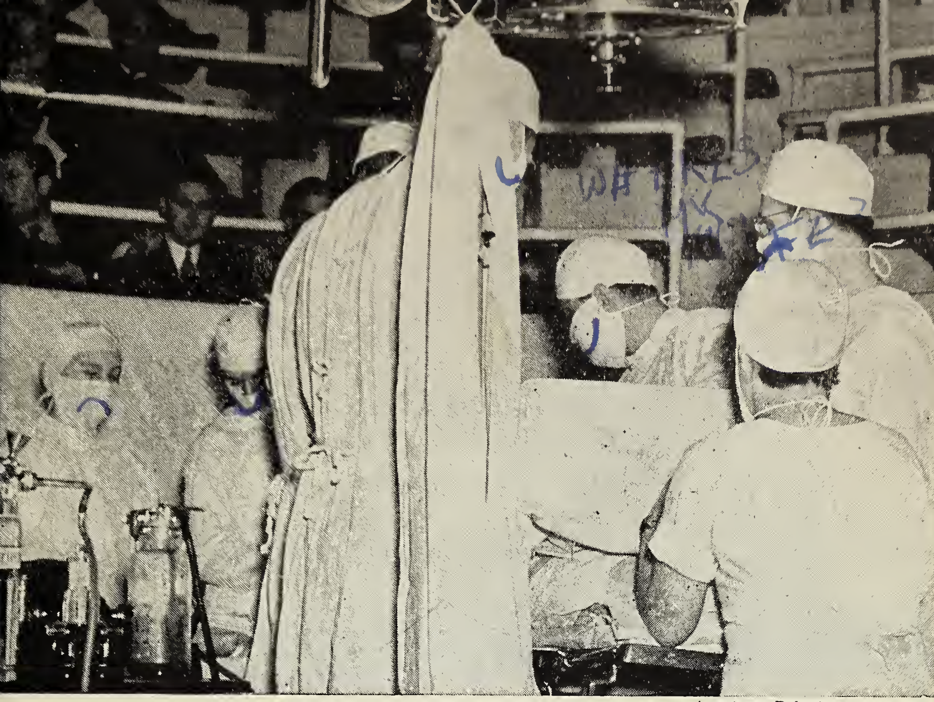
In Canada the provinces make many of their own sanitation laws and regulations. The Dominion National Health Branch assumes responsibility for pure-food laws and for regulations to cover handling, canning, packaging, and labelling of foods prepared for sale to the public. Meat, eggs, butter, cheese, and poultry are subject to close examination and are graded and labelled in such a way as to protect the purchaser, who can thus know exactly what he is paying for.

Public-Health Nursing

The hospital nurse in her smartly tailored, spotless uniform and cap has become a familiar and highly respected figure in our modern life. Since that splendid woman, Florence Nightingale, with courage and devotion faced the horrors of the Crimean War to bring comfort and ease to the wounded soldiers, nursing as a career has had a great appeal to girls of education and personality. It now ranks high in the professions. But all nurses are not in hospital wards. The blue uniform of the public-health nurses is becoming almost equally well known. Every provincial health department, every city health department, every health unit, and many voluntary agencies employ them. They are the links between the organization and the home and are important in health education.

Some public-health nurses give bedside care to patients in their homes. Familiar in this group are the Victorian Order Nurse and those of the St. Elizabeth Visiting Nurse Association. They carry on all types of health teaching in the home and the community as well. Other public-health nurses do not give bedside care except in emergency. A few, particularly in isolated districts, combine the bedside care with educational services. A case of this in Saskatchewan is at Cumberland House, a northern outpost reached only by plane, canoe, or dog team, where one nurse, working in a small nursing station, gives every type of service.

In general, public-health nurses work directly under the control of the medical health officer. They organize and assist with school health inspection, health centres, immunization, home nursing, and first-aid classes. They visit homes and organizations. An important phase of their work is the free distribution of literature on child care. Certain voluntary agencies, such as the Canadian Welfare Council,



Armstrong Roberts

An operation in a modern hospital.
What has been done to prevent wound infection?

the Junior and Senior Red Cross Societies, and many insurance companies, are responsible for the preparation of this valuable material.

Hospitals

We do not know exactly when the first hospital in the world was opened for the care of the sick. Some historians say it was the one founded about 390 A.D. by a Roman lady named Fabiola.

In Canada there are many hospitals all controlled through provincial health legislation. Public hospitals receive financial help in the form of grants from the provincial

government, amounting to about fifty cents per patient per day. Private hospitals must conform to the health regulations, but do not receive financial aid from the provincial government.

There are many types of public hospitals for the general care of the sick: municipal or county hospitals and rural or urban hospitals operated by means of local taxation; community hospitals operated through local subscriptions; hospitals maintained by religious orders of the Roman Catholic Church; hospitals operated in isolated areas by Protestant churches; Red Cross hospitals; Salvation Army hospitals; and others. In the West, particularly in the province of Saskatchewan, there are Union Hospitals, which are organized by several municipalities together and operated by taxation. There are also special hospitals for the care of children; for mentally sick people; for tuberculosis cases; and for the aged sick. In recent years people have become interested in hospital insurance plans. Under these schemes people pay a small sum at regular intervals. Then if they have to go to a hospital, the bills are paid out of the accumulated funds.

Laboratory Facilities

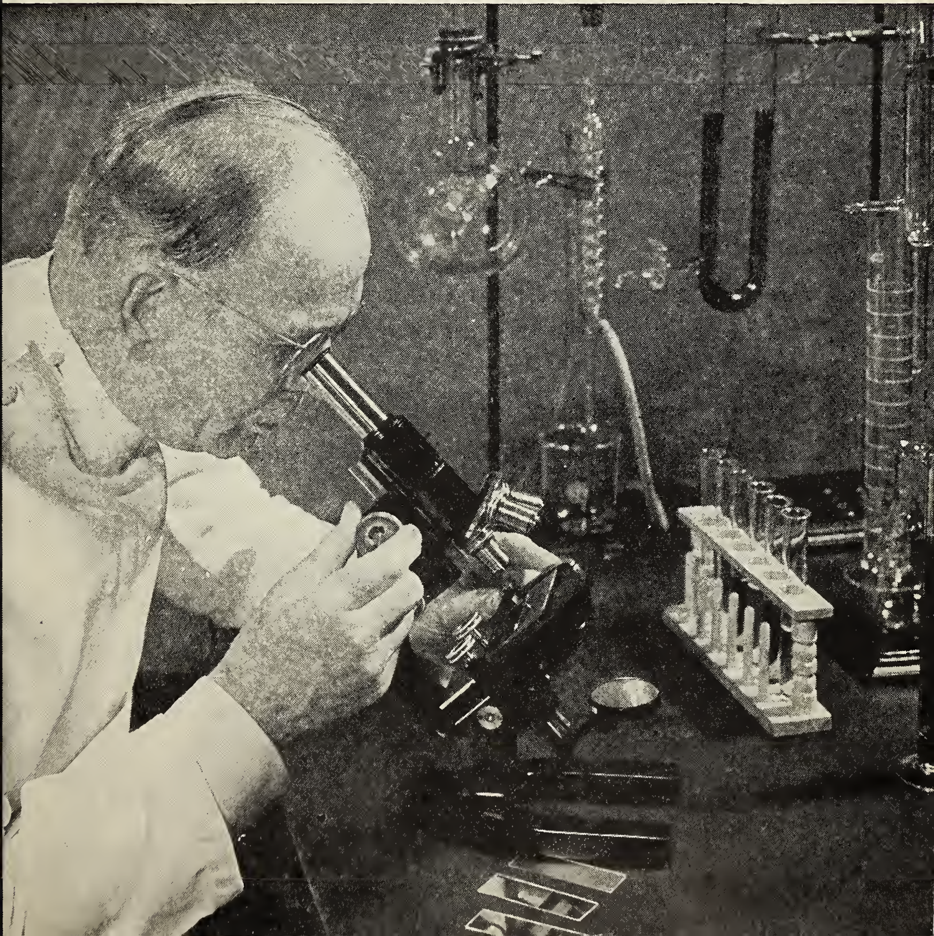
Another service in a modern health department is a laboratory for the tests necessary for the diagnosis and the prevention of certain diseases. For instance, if a doctor thinks a child has, say, diphtheria, he takes some of the discharge from the throat and sends it to the laboratory. Here it is examined for the germs which cause diphtheria. With the resulting information the child's doctor knows better how to treat the disease.

The laboratory doctor can often help to find the source of a disease. Some people are carriers, that is, they can

give other people a disease without developing any symptoms themselves. Examination of numbers of people in a locality or a home or a school will often locate this carrier. Milk and water samples are examined in the laboratory, too. This is a fine service and does much to prevent the spread of diseases. Doctors and health workers could not get along without a public-health laboratory. Perhaps some day your class may have a chance to visit one. You will find it a fascinating place.

In a health-department laboratory.
Searching for the germs that are making someone ill

Galloway



ARE YOU DOING YOUR BEST TO WORK WITH OTHER PEOPLE FOR HEALTH?

Do you obey quarantine and isolation regulations when the health department is obliged to put them into effect?

Do you avoid crowded places and stay cheerfully at home when the health department requests you to do so during an epidemic?

Do you try to keep away from people who cough or sneeze without covering the mouth and nose?

Are you using the knowledge you have learned in school about the body and its care to develop good health habits?

Do you visit your family doctor each year for a checkup so as to prevent illness?

Are you acquainted with the hospital insurance schemes that are available in your province?

Do you do what you can to co-operate with all the forces in your community that are working for the health and the safety of the citizens?

TRY THESE TESTS

1. Tell what you think of in connection with each one of the following terms:

reportable disease	birth registration
research workers	death registration
communicable-disease contact	birth rate
public health nurse	death rate
Union Hospital	span of life
vital statistics	expectation of life at birth

2. Using the following records of vital statistics for the city of Centreville last year, find the birth rate of the city per 1000 population and the death rate per 1000.

City of Centreville

Population July 1	25,000
Number of deaths	278
Number of births	301

THINK ABOUT THESE QUESTIONS

1. What are some of the things done by the health department in your community to prevent the spread of communicable disease? When there are a great many cases of scarlet fever or measles among school children in the community, what are some of the things the school nurse does to protect the well children? What are some of the ways in which the health department educates the people of your community in health matters? What are some of the ways in which each individual must depend on his own efforts to protect himself and his family and his neighbors from communicable disease?

2. The statement has been made that "public health is purchasable." What is meant by this statement? Do you think that the taxpayers' money is well spent when it is used to engage school or town nurses? to keep the streets clean and well lighted? to inspect eating places? to inspect milk and water supplies? to maintain a health-department laboratory? Give reasons for your answers.

3. Why is it important to investigate the health record of a town, as shown by its vital statistics, before deciding to settle in the town?

DO THESE THINGS

1. Appoint a committee of the class to visit the department (or board) of health or the health officer of the community. Have the committee find out and report to the class what the health department does to protect the health of the citizens. What is done to ensure pure milk and water? What are the rules for isolation and quarantine? What diseases are reportable? If the health department maintains a laboratory, ask to see how milk supplies are tested. Find out what the laboratory does to help the private physician to diagnose a case of diphtheria; of typhoid fever; of pneumonia; of tuberculosis. What vaccines and serums are available for free distribution to physicians and clinics?

2. The following table shows the death rate from diphtheria per 100,000 population in Canada for various years:

1929	9.8	1933	2.2	1937	3.3
1931	6.8	1935	2.4	1939	3.0

The great majority of these deaths took place among children. Find out when toxin-antitoxin to protect babies from diphtheria first came into general use. Using the table above make a graph to show how the death rate from diphtheria has been lowered since 1929. What is the connection between the discovery of toxin-antitoxin as a means of preventing diphtheria and the great decrease in the number of deaths from this disease?

UNIT X

A Safe and Nutritious Food Supply

When people first began living in groups, all sorts of problems arose which communities have to this day. In former times the most important problem was how to get enough water and food. In communities today one of the chief concerns is how to provide pure water and milk and nutritious foods.

DO YOU KNOW

Whether water that looks clean and sparkling is always safe to drink?

The three chief ways in which impure water may be purified?

How to pasteurize raw milk at home?

How health departments protect citizens from the dangers of unclean food?

How cooking helps to make foods safe?

What we are actually buying when we buy foods?

PROTECTION OF WATER SUPPLIES

The original source of all our water is rainfall. Falling rain is pure. It is only when it strikes the surface of the earth that it becomes polluted with dirt and germs. Surface water flowing into any place where water collects, such as a spring, well, brook, river, pond, or reservoir, may carry with it harmful germs. This is why it is important to protect from surface drainage all bodies of water that are used as a source of drinking water.

Wells and springs should be provided with tight close-fitting covers. Stables and outhouses should never be located in places where drainage from them may seep down into a well or spring or any other body of water used as a drinking-water supply. In general, a well should always be located on the highest ground possible. The water level in the well must be higher than any possible source of pollution such as barnyards, manure heaps, and outdoor toilets.

Water from shallow wells and springs should be tested at regular intervals. In most provinces the provincial department of health will examine samples of drinking water in order to determine its purity. It is well always to remember that just as all is not gold that glitters so all is not pure that looks pure or clear. Water that is odorless and looks clean may be far less pure, in the sense that it is free of germs, than water that looks and smells dirty. Unless you are sure that the water from a brook or wayside spring is pure you should boil it before drinking it.

With the growth of towns and cities the problem of getting an adequate supply of pure water became a community rather than an individual problem. Purifying water so that it cannot be the means of spreading communicable disease is the most important work of those who have charge of a community's water supply.

Purification of Water Supplies

The three chief ways in which water is purified are by storage, filtration, and disinfection. The storage method is based on the fact that bacteria cannot live in water for a very long time. As surface water drains into a brook and the brook flows into a large stream and the stream into a lake, solid materials settle out and harmful bacteria (which are used to living in the rich warm fluids of the body) will starve to death for lack of food. If no new pollution occurs, the disease bacteria will all be dead in two weeks or so. Storage in a natural lake or a reservoir is, therefore, a very good way of purifying water. However, the greatest precautions must be taken to guard such a body of water from pollution. No houses may be built around it, and notices are put up warning people not to pollute the water.

In case the water supply of a community is too polluted to be treated by storage, it may be purified by filtering it through sand. As water percolates, or passes through, the sand in a filter, bacteria are caught and held on the surfaces of the sand grains. The first sand filters were built in London in 1829. Since then filtration has been adopted by most cities that use river water. More than twenty-five million people in North America drink filtered water.

Water which is fairly clear and is not too highly polluted may be freed from disease bacteria by chemical disinfection. This method of purifying water is valuable for use in emergencies when it is necessary to protect the public immediately from infected water. It also is used frequently in combination either with storage or with filtration. Chlorine is the disinfectant commonly used. Minute amounts of this gas will destroy disease bacteria without harming the water in any way. Usually the gas is fed directly into the water by a special device called a chlorinator.

GUARDING THE MILK SUPPLY

On many dairy farms the health of the cows is carefully watched. Physical examinations, including blood tests, are made from time to time. If any cow is found not to be in the best of health, she is kept away from all other cows and her milk is not used until a veterinarian, or animal doctor, says she is entirely well.

To prevent the contamination of milk by milkers who may be infected with disease germs, the health authorities of many communities require the frequent medical inspection of all milk-handlers. The milkers are also trained in habits of cleanliness. Before milking the cows they must wash their hands thoroughly with soap and water and then with a disinfectant. They must put on clean white suits and caps. The udders of the cows are washed before each milking, and the milk pails are sterilized.

Milk is warm when it comes from the cow. Cooling it helps to prevent the growth of bacteria that cause souring or spoiling. On most dairy farms milk warm from the cow is carried immediately to a milkhouse, where it is strained and poured through a cooler into big cans which have been sterilized. The cans of cool milk are then placed in a refrigerator room where they are kept at 50 degrees Fahrenheit, or less, until they are taken to the country milk stations.

From the country milk stations milk is taken into a city in tank trucks or in express milk trains. The stainless-steel tank cars which make up a milk train are lined with glass and are so well insulated that the milk does not change its temperature by a degree during a long journey. When the milk reaches the city receiving station it is pumped out of the tank cars through stainless-steel equipment and is then pasteurized and bottled.

In a modern bottling plant machines take complete

charge of the bottles. These machines clean the bottles, sterilize them, fill them with pasteurized milk, and cap them tightly, all without aid of human hands. Cleanliness is the first consideration. Twice a day every pipe and vessel which the milk touches is taken apart, scrubbed, sterilized, and then put together again.

The Pasteurization of Milk

In spite of the utmost precautions taken to handle milk in a cleanly manner there is always a chance of failure in the chain of defence against infection. Fortunately we have the added defence of pasteurization, which is done just

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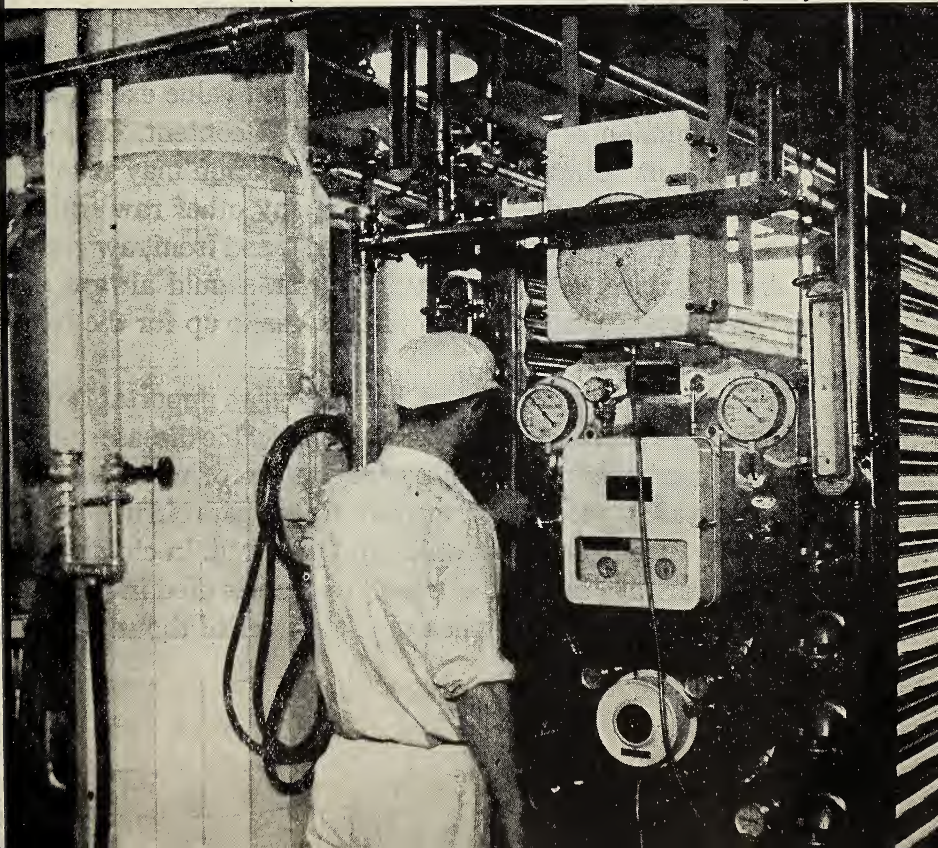
In pasteurizing milk the temperature must be carefully regulated

Galloway

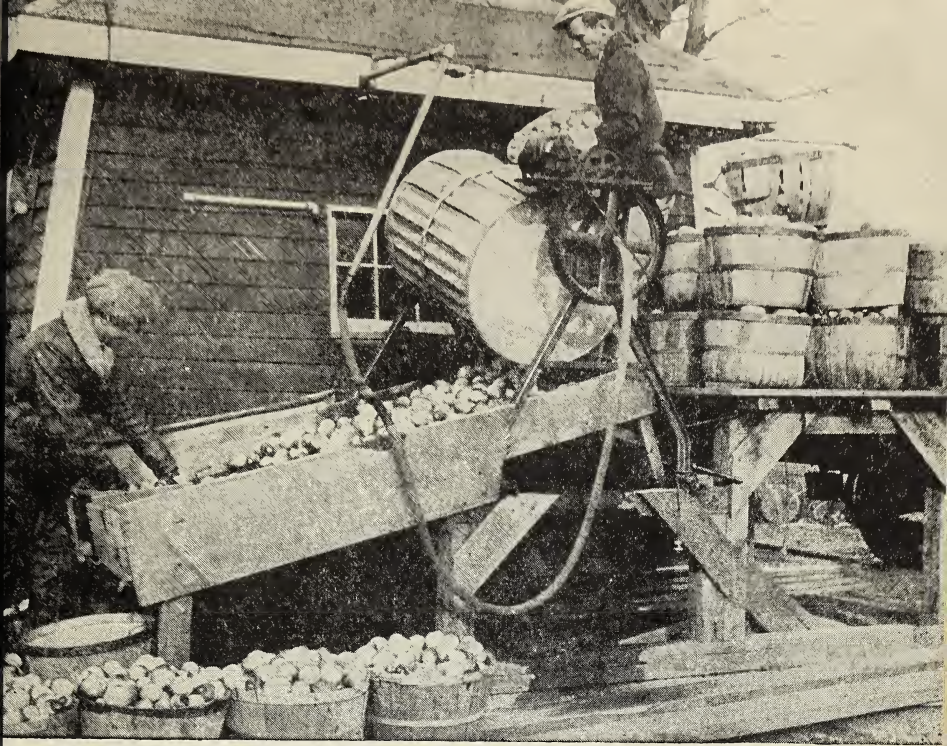


before the milk is bottled. Pasteurization consists in heating milk to a degree high enough to destroy disease germs and other bacteria that might cause milk to sour or spoil quickly. The process ordinarily used is to heat the milk to a temperature of from 142 degrees to 145 degrees Fahrenheit and to hold it at this temperature for at least half an hour. It is then promptly cooled to a temperature of 50 degrees or lower.

On farms and other places where pasteurized milk cannot be purchased, home pasteurization may be carried out by placing the milk in the top part of a double boiler and heating it by boiling water in the bottom part of the boiler until a dairy thermometer placed in the milk registers 155 degrees Fahrenheit. The milk must then be removed from the stove and cooled as rapidly as possible by placing cold water in the bottom part of the double boiler and changing the water repeatedly until the milk is chilled.

When properly done, pasteurization does not change the taste of milk or take away any of its food value except for the destruction of part of its vitamin-C content. This is unimportant because supplies of this vitamin may readily be obtained from citrus fruits and many other raw fruits, from tomatoes (either fresh or canned), and from raw vegetables. Babies fed on pasteurized milk should always be given orange juice or tomato juice to make up for the lack of vitamin C in the milk.

The pasteurization of milk has played an important part in the reduction of deaths from communicable disease, especially among infants. The pasteurization of milk became widespread in 1907. A person now forty years old may very possibly owe his life to a safe supply of milk in childhood. Fifty years ago one out of every five babies died in its first year of life. Infant diarrhea took the lives of thousands of babies every summer.



Keystone

Farmers washing apples before sending them to market

PROTECTING FOOD OUTSIDE THE HOME

To a large extent our food supplies are guarded by government regulations so as to protect us against the presence of chemical poisons. Since farmers are obliged to spray fruit trees and vegetables with poisonous chemicals in order to kill insects and parasites that might otherwise damage their crops, regulations have been made which require the farmers to wash fruits and vegetables before sending them to market. However, as we occasionally hear of cases of poisoning caused by chemicals such as the lead or arsenic used in sprays, it is important to wash thoroughly all fruits and vegetables, whether they are to be cooked or to be eaten raw.

Another possible source of chemical poisoning is the use of adulterants in preparing foods for sale. An adulterant is something added to a food to preserve it, to make it more attractive to the eye, or to substitute a cheap ingredient for a more expensive one. Laws known as food and drugs acts protect citizens of the United States and Canada from food and drugs which are adulterated with harmful substances or which are misbranded. Misbranding means the use of an untruthful or misleading label. If it is suspected that the label on a package or bottle does not tell the truth about the contents, government inspectors obtain samples of the product and have them analyzed in a laboratory. If it is proved that the manufacturer has violated the law, the product can no longer be offered for sale and the violators may be punished.

Some harmless adulterants are permitted by law, but their presence in a food must be noted on the label. The use of chemicals such as benzoic acid and benzoates for preserving foods and of certain substances for coloring butter and candies is permitted. Other substances known to be dangerous, such as formaldehyde for preserving milk and copper salts for making vegetables look green, are prohibited. Look over packaged and bottled foods on the shelves of your kitchen cabinet and note how they are labelled.

One reason for reading the labels on packaged foods is to find out how much they weigh. When you buy meat and fresh fruits and vegetables and

Government inspectors taking a sample from a shipment of frozen egg yolk in order to have it analyzed

other foods that are not put up in packages, the storekeeper weighs out on his scale the amount you wish to buy. On the scale you may see a seal or stamp that has been put there by a government inspector who has tested the scale and found that it gives correct weight. When you buy food in cans and bottles and boxes you will see printed on the label the net weight of the food inside. It is a good idea to note just how much food, and not how much bottle or box or can, you are getting for your money.

Protection against Toxin-Forming Bacteria

Food may be made unsafe to eat by the toxins, or poisons, formed by certain bacteria, as well as by chemical poisons. A germ sometimes develops in canned or preserved foods which have been imperfectly heated and produces a deadly toxin causing the disease known as botulism.

In order to avoid the risk of botulism and other forms of food poisoning caused by toxin-producing germs, never use any food which appears to be spoiled. No food should even be tasted if it has the slightest unnatural odor or color. In nearly every case of botulism it was reported that the food responsible for the poisoning had an offensive or an unnatural odor. Never use food from cans which bulge at the ends. The swelling of the can indicates the presence of gases which may have been produced by toxin-forming germs.

Protection against Infection

A more common cause of food contamination is the presence of disease germs or parasites which infect the person who eats the food and produce a particular disease. There are three ways in which the food may be contaminated. First, meat from a diseased animal may contain parasites, such as the parasite trichina, which causes a disease called

trichinosis. Second, the intestinal discharges of rats and mice may infect food with the germs of certain intestinal diseases. Third, foods may be contaminated with germs from the bodies of human beings. Epidemics of typhoid fever and dysentery have been traced to the handling of foods by human carriers of the germs of these diseases. Food also may be contaminated by flies which have crawled over human discharges containing disease germs.

To protect the public from the danger of eating meat from diseased animals, the inspection of meat offered for sale is required by law in Canada. The inspection of cattle, meat, and dairy products is controlled by the Dominion Department of Agriculture.

To protect the public from food contaminated through unsafe handling, the health department in most cities and large towns employs inspectors to supervise places where food is sold. These stores must have a health-department permit in order to operate, and severe penalties may be imposed on merchants who do not observe sanitary precautions. Foods that will not be cooked after purchase, such as cheese, tub butter, and bakery goods, must be kept in glass cases away from flies, rats, mice, dust, and handling by the customers. Fruits and vegetables must be protected in the same way as far as possible. Meat and fish must be stored in refrigerators and displayed only on ice.

THE CARE AND PREPARATION OF FOOD IN THE HOME

As soon as food arrives in the home, the perishable foods should at once be stored in a refrigerator or icebox. This helps to keep perishable foods fresh and retards the growth of bacteria that might otherwise cause the foods to spoil.

Wide World

A pancake-making contest.
These boys are proving that cooking is an art

The history of invention shows that the discovery of one very simple principle often leads to a thousand and one different ways of using it. So it was with the discovery that heating food makes it more tasty. Cooking became an art, with cooks as the artists, and in every age of history we hear the praises of good cooks and good cooking sung. This is as it should be, because appetizing food not only adds to the enjoyment of life but aids digestion, by stimulating the flow of the digestive juices.

Cooking also helps to make foods safe, because heat when applied for a sufficiently long time kills all the germs of the ordinary communicable diseases. Cooked food coming from the kettle usually is biologically clean; that is, it is free from harmful germs.

Cooking also destroys certain parasites, such as the hookworm, tapeworm, and trichina, which may be found in the meat from diseased animals. Although great precautions are taken by the government in the inspection of meat, it sometimes happens that meat from an infected animal may come on the market or it may be consumed on the farm where the animal was raised. Some deaths occur each year from the disease trichinosis, which is caused by the trichina parasite, or flesh worm. This parasite is found usually in infected pork or in food prepared from infected pork, such as sausages. The parasites are destroyed when the pork is cooked *thoroughly*. Merely frying pork over a flame for a few minutes does not make it safe. Frequently a fried or broiled pork chop, while cooked on the outside, remains almost raw on the inside. In that state not only is the meat indigestible but also there is danger of getting trichinosis. Pork is just as nutritious as other meat, but it must be *thoroughly cooked*.

The four principal ways of cooking food are boiling or steaming, baking or roasting, broiling, and frying. Of these, frying is the least desirable because fried foods usually are soaked in fat. Neither saliva in the mouth nor gastric juice in the stomach can act on fat. Therefore foods covered with fat cannot be digested until they

How may you help to keep germs from "catching a ride" into your body on foods that you carry to your mouth with your fingers?

reach the small intestine. This means that part of the starch in fried carbohydrate foods, such as fried potatoes and doughnuts, and part of the protein in fried meats and eggs may escape digestion.

In boiling vegetables, contact with the oxygen of the air destroys part of the vitamin-C content. For this reason vegetables should be boiled in covered vessels and for as short a time as possible. As mineral salts present in vegetables dissolve in the cooking water, this water should be saved and used in sauces and soups.

Handling Food in the Home

Strict cleanliness in preparing, serving, and eating food is a great help in the control of communicable diseases. The protection given by the government regulation of foods offered for sale and by the refrigeration and cooking of food in the home may go for nothing if food ready to serve is sneezed on or eaten from unclean dishes and silverware or handled with dirty fingers.

Do you sometimes help to prepare the meals at home? Are you ever asked to slice the bread or pour the water and milk or to put the butter or jelly or cake on the table? Before starting to prepare food or to set the table always wash your hands first with soap and water. Before pouring milk from the bottle wash the top of the bottle and wipe it with a clean cloth. Be careful not to touch the rims of glasses with your fingers when you pour milk or water. Never cough or sneeze on food. If you should drop a slice of bread or a piece of cake on the floor, pick it up and throw it into a garbage can. Even if there were no living germs on the floor, it is not pleasant to eat food soiled with the dirt from people's shoes. Protect food from flies and dust by keeping it covered until it is ready to serve.

BUYING FOOD AND PLANNING MEALS

In buying food we are first of all buying heat and energy. The energy value of a food is measured by the number of calories, that is, heat units, that the food contains. Each individual must take in each day a certain number of calories in the form of food in order that his energy requirements may be met.

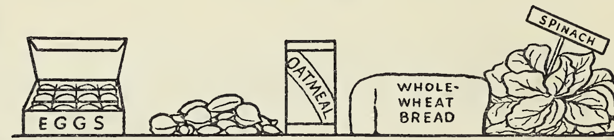
The amount of energy a person needs varies slightly with age, sex, and season and decidedly with size, body build, and degree of activity. A boy or girl who engages in active sports after school hours will need more calories than a boy or girl who spends a great deal of time reading or working at a hobby or playing quiet games. In the table below you may find the energy requirements of the average individual as worked out according to age by Dr. H. C. Sherman.

Age in Years	Number of Calories Per Pound	Approximate Number of Calories
Under 1	45	900
1–2	45–40	1000–1100
2–5	40–36	1100–1500
6–9	36–32	1600–1900
10–13	34–27	2000–2700
14–17	30–32	2500–3400
18–25	25–18	3400–3800
30	2750 calories for a man of 152 pounds	
40	2500 calories for a man of 154 pounds	
60	2300 calories for a man of 150 pounds	
70	2000 calories for a man of 134 pounds	
80	1750 calories for a man of 139 pounds	

The other things we buy when we buy food are materials for the building and repair of muscle, bone, and blood and for protecting health and regulating body activities. In the tables on pages 201 to 204 you will find the names of the principal food elements you need and what they do for you.

Buying Energy, Building Material, and Body-Regulating Material

Name of Food Element	*What It Does for You*	*Principal Foods in Which You Buy It*
Carbohydrate (sugar and starch)	Both carbohydrate and fat supply heat and the energy needed by the body to carry on all its physical and mental activities	Cereals, bread, potatoes, sugar, molasses, dried fruits, and other sweet foods 
Fat		Butter, margarine, bacon and other fat meats, olive oil and other vegetable oils, lard and vegetable shortening, nuts 
Protein	It furnishes the body with material for building and repairing the tissues of the body. It also supplies some energy	Milk, cheese, meat, eggs, and fish 
Calcium Phosphorus	Calcium phosphate, a combination of calcium and phosphorus, is the principal ingredient of bones and teeth. In babies a lack of one or the other of these minerals results in rickets, a disease in which the bones are soft and poorly formed	Milk, cheese, green vegetables, root vegetables, dried legumes, nuts, and dried fruits, such as figs, prunes, and currants 

<table>
<tr><td>Iron</td><td>It is necessary for building the hemoglobin of red blood corpuscles. A lack of iron in the diet may result in fewer red corpuscles or in corpuscles which do not contain enough hemoglobin or both. This condition is called anemia</td><td>Eggs; liver; dried beans and peas; dried fruits; green leaves, such as kale, turnip greens, dandelion greens, and spinach; whole-grain products; and nuts

</td></tr>
<tr><td>Iodine</td><td>It furnishes the thyroid gland with the iodine necessary for manufacturing a secretion that helps to regulate the speed of body activities. It helps to keep the thyroid gland in a healthy condition. A lack of iodine in the diet may result in a swelling of the thyroid gland called simple goiter</td><td>Oysters, clams, lobsters, and other sea food; vegetables raised in soil containing iodine salts. In places far removed from the seacoast iodine may be obtained by using iodized table salt or by drinking water to which iodine has been added by the health department

</td></tr>
<tr><td>Cellulose</td><td>It furnishes the roughage which is necessary to encourage the normal removal of waste from the large intestine. A lack of cellulose in the diet may result in constipation</td><td>The outer coats, or bran, of whole grains, present in whole-grain breads and cereals; the tough skins and fiber of fruits and vegetables

</td></tr>
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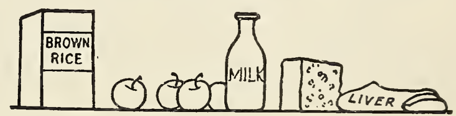
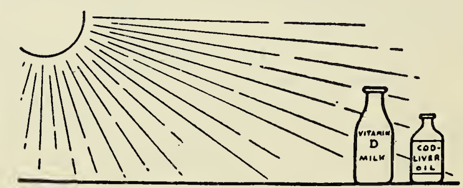
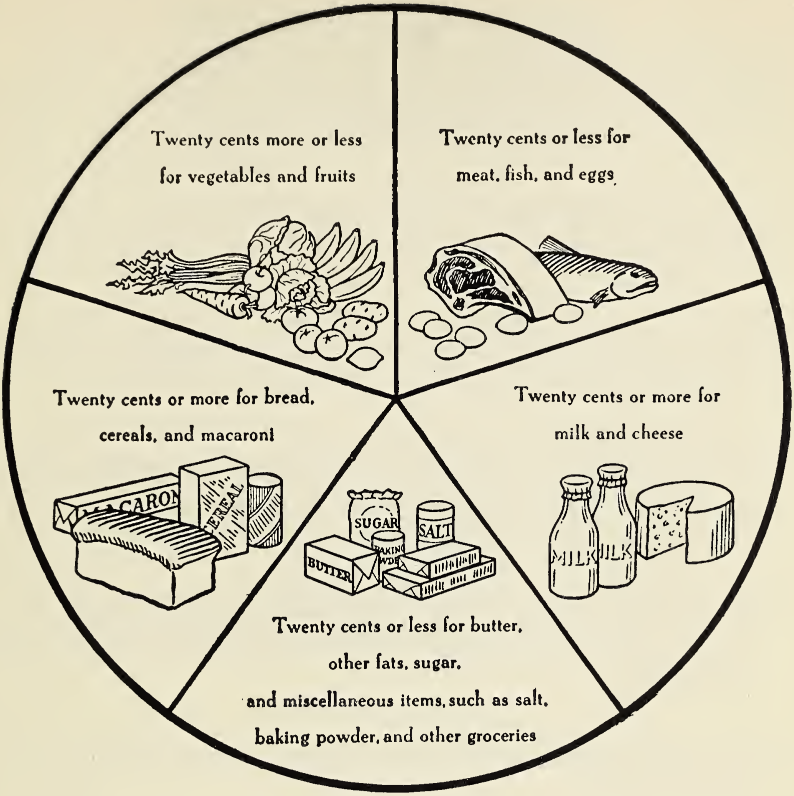
Buying Health Protection

Name of Vitamin	*What It Is*	*What It Does for You*	*Principal Foods in Which You Buy It*
Vitamin A	A clear colorless oil known as pure vitamin A or a yellow coloring matter, carotene, which is found in plants and is changed by the body into vitamin A. It does not dissolve in water but dissolves in liquid fat	It helps to protect you against infections, especially colds. It helps to form tooth enamel. It helps to keep the skin in a healthy condition. It makes it possible for you to see clearly in a dim light. A lack of vitamin A may cause night blindness and a disease of the eyes called xerophthalmia	Butter, milk, green vegetables, yellow root vegetables, eggs, and fruits. Fish-liver oils in liquid or capsule form are very good sources of vitamin A 
Vitamin B_1	White needle-like crystals which dissolve in water	It helps to give you a good appetite. It aids digestion and the removal of intestinal wastes. It helps to keep the nervous system in a healthy condition. It helps your body cells to use as fuel the starch and sugar in your daily meals. A lack of vitamin B_1 causes a disease of the nerves called beriberi	Whole-grain cereals, milk, eggs, and most vegetables and fruits. Yeast and wheat germ are the best sources of vitamin B_1. Nuts are a good source 
Vitamin B_2	Yellow-brown needle-like crystals which dissolve in water	It is essential for growth in rats and is probably needed in the diet of human beings. A substance called nicotinic acid closely associated with vitamin B_2 in many foods prevents and cures a disease called pellagra	Whole-grain cereals, fruits, vegetables, dairy products, meats, and fish. Kidney and liver are especially good sources of vitamin B_2 

Vitamin C	White cube-shaped crystals which dissolve in water	It helps to form and to maintain your teeth. It keeps your mouth and gums in a healthy condition. A lack of vitamin C causes a disease called scurvy which is characterized by sore and bleeding gums, loose teeth, pain in the joints and muscles	Citrus fruits (such as oranges and grapefruit), tomatoes, and other raw fruits and raw green vegetables 
Vitamin D	A crystal substance which will not dissolve in water but will dissolve in liquid fat. In the summer your body makes this vitamin when the ultraviolet rays of the sun fall on your bare skin	It makes it possible for the body to use calcium and phosphorus in building bones and teeth. In babies a lack of vitamin D causes rickets	Vitamin-D milk (milk which has been enriched with vitamin D by exposing it to ultraviolet-light rays or by adding concentrated cod-liver oil to it or by giving cows a food rich in vitamin D) and fish-liver oils, such as cod-liver oil or halibut-liver oil in liquid or capsule form. Either vitamin-D milk or fish-liver oil should be taken in the late fall and winter when very few ultraviolet rays reach the earth from the sun 

NOTE. The vitamins described in the table above are not the only ones, but not enough is known about the others to make it possible to answer questions about them



How each dollar that a family has for food should be spent. Why is it a good plan to divide the food money in this way?

A large part of the cost of fresh milk is due to the care that must be taken in handling and shipping it in order to keep it pure and sweet until it reaches your home. Evaporated milk and dried milk usually are cheaper pound for pound than fresh milk because the cost of evaporating and canning is actually less than the cost of handling and shipping fresh milk.

The same is true of canned fruits, vegetables, fish, and other foods. Modern commercial methods of canning preserve the food value of the fresh product.

ARE YOU DOING YOUR BEST TO HELP IN THE PROVIDING OF PURE WATER AND MILK AND NOURISHING FOODS?

Are you careful not to pollute any body of water used for drinking purposes?

If you are not certain of the purity of any water you wish to drink, do you boil the water before drinking it?

Are you careful not to touch the bubbler with your lips when you drink water from a bubble fountain?

Do you know how to pasteurize milk in case you live in a place or are going to a place where pasteurized milk is not available?

Do you help to keep the milk used in your home clean, cold, and covered?

Do you handle food and dishes in a cleanly manner and always wash your hands before eating or preparing food?

Do you keep in mind the essentials of a healthful diet when you are made responsible for buying food?

Can you plan a well-balanced meal?

THINK ABOUT THESE QUESTIONS

1. What are some of the ways in which water may be made unfit for drinking? Can you tell by looking at it whether water is free of harmful germs? How do you know that the water you drink is safe to drink?

2. How can you tell that the milk served in your home is free of disease germs? Under what circumstances would it be safer to use evaporated or dried milk?

3. What is one of the principal reasons for the fact that life is safer for babies born this year than it was for babies born in 1900?

4. Why should laws be made to protect the citizens who buy food in stores and restaurants? What are some of the laws and health-department regulations which protect the consumers in your community? Against what dangers or frauds do these laws protect?

5. What are the advantages of cooking food? What are the four different methods of cooking? Which are best?

TRY THESE TESTS

1. Tell what you associate with each of the following words or terms:

adulterant	pollution
misbranding	refrigeration
botulism	pasteurization
trichinosis	calorie

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. Pasteurization is one of the three ways in which water is purified.
b. Water is said to be polluted when it is free of harmful germs.
c. The chlorination of milk has played an important part in reducing the death rate among infants.
d. Laws enacted to control the purity of food and the sale of drugs protect citizens of Canada from false or misleading advertising.
e. It is dangerous to use any food which appears to be spoiled.

f. Perishable food should be kept at a temperature of about 60 degrees Fahrenheit.

g. Cooking has no value except to make food more appetizing.

h. Frying is the least desirable method of cooking.

i. It is the act of a good friend to offer another a bite of the apple he is eating.

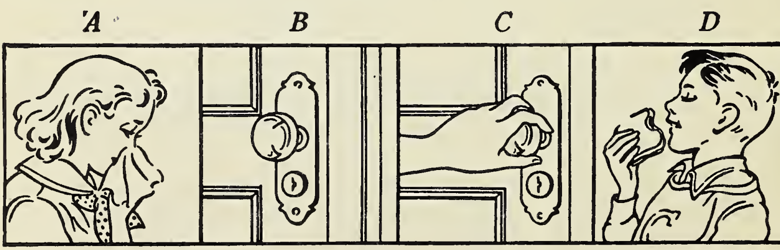
DO THESE THINGS

1. If possible, the class may visit the community water-supply system and observe the methods used for protecting and purifying the water. If the school is in a community that has no public water-supply system, each member of the class may describe the water supply of his or her home and what measures are taken to keep the drinking water pure.

2. Appoint a committee of the class to visit the local health department and find out what measures are taken to secure the sanitary handling of food in places where food is sold in your community. After the committee has made its report, discuss in class the ways in which each citizen may co-operate with the health department in protecting food offered for sale.

3. Draw diagrams to show how the germs of communicable diseases may be passed from person to person by indirect contact; that is, by handling or using something that has been handled or used by someone else.

Example:



Person with a cold	Doorknob handled by *A*	Hand of *C* touching *B* after *A* touched it	*C* eating a sandwich with unwashed hands after touching *B*

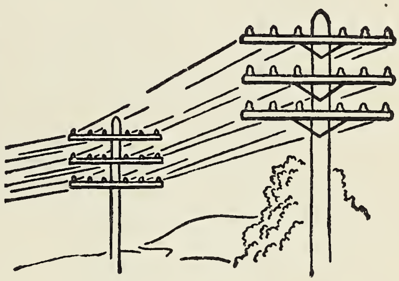
UNIT XI

How the Body Is Governed

The nervous system controls our relationships with the outside world. It gives us the power to see, to hear, to touch, to taste, to smell, to move, to think, and to solve problems. If we had no nervous systems, we should be cut off completely from everything in the world about us which makes life interesting and worth while.

DO YOU KNOW

In what ways the nervous system is like a telephone system?



Why food is tasteless when you have a cold?

Why we instantly draw the hand away from a hot stove without thinking?

What part of the nervous system makes man master of the universe?

How we can plan to get enough restful sleep?

How boys and girls can practise mental hygiene?

The nervous system, of which the brain and the spinal cord are the centre, links together the various parts of the body, controls their activities, and makes them work together for the good of the whole. Every cell in your body has a life of its own; but all these twenty-six billion lives make one life, your life, because your nervous system unites them all.

Like all the other parts of the body the nervous system is made up of cells. Most of these cells are collected together in the brain and spinal cord. Perhaps you have heard it said of a person who is not very bright, "He doesn't have much gray matter." The gray matter of the brain and spinal cord is made up of nerve cells. Because the nerve cells must connect parts of the body which may be far away from each other, one or more threadlike nerve fibers extend from each cell. Some of these fibers are three feet long or more. A great many nerve fibers bundled together in a sheath, or wrapping, of connective tissue form a nerve. One nerve, such as the main nerve which runs to your leg, may be as thick as a lead pencil, but the millions of fibers which compose it are so slender that they can be seen only with the aid of the microscope.

The nerve fibers may be compared to one-way telephone wires connecting two stations. Each incoming wire runs from a point on the inside or outside of the body to the central nervous system. Each outgoing wire runs from the central nervous system to a muscle fiber. Thus we see that one of the two stations connected by each nerve fiber

▪ ▪

The girls who handle calls at a telephone switchboard are kept very busy. However, their work is light compared with the work of the central nervous system, which handles thousands of incoming and outgoing messages every min


TH AMERICA
A • CHILE • COLOMBIA • COSTA RICA • CUBA
O • NICARAGUA • PANAMA • PARAGUAY • PERU
EZUELA

is always the central nervous system. It is like a great telephone switchboard into which or from which every telephone wire in a district runs.

The stations on the outside of the body from which the incoming nerve fibers run to the central nervous system are the sense organs. These organs are cells or groups of cells which keep the brain or spinal cord in touch with the outside world.

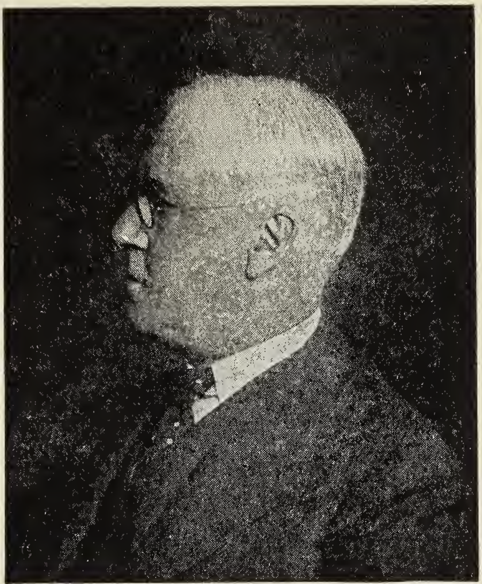
To explain how the sense organs work we must use certain words with which you may not be familiar. These words are *stimulus* (plural *stimuli*), *respond*, and *sensitive*. A stimulus is a force, or impulse, which causes action. A whip or a spur, for example, is a stimulus which makes a horse move more quickly. In speaking of the action aroused by a stimulus we use the word *respond*. That is, when a horse suddenly leaps forward at the prick of a spur, we say he has responded to the spur. The word *sensitive* comes from a Latin word meaning "to feel." Anything which responds quickly to a stimulus is said to be sensitive to it. That is, a horse is sensitive to the prick of a spur.

The Special Senses

The body has five different kinds of sense organs—those of sight, hearing, touch, taste, and smell. Each kind is sensitive to one particular stimulus from the outer world. The sense organs of sight are located only in the eyes; the hearing organs, only in the ears. The organs of touch are stationed all over the skin from head to toe. The taste organs are located in papillae, or little knobs, on the surface of the tongue. They are called taste buds. Each one of the taste buds reports one particular taste to the central nervous system. Some taste buds are sensitive to bitter substances only, some to sour, some to sweet, and some to

salt. You cannot taste candy with a taste bud sensitive to salt, nor a sour pickle with a taste bud sensitive to a sweet substance.

The organs of smell are located in the nose. They are stimulated by showers of tiny invisible particles given off by substances which have an odor. Smell is the partner of taste. Often, when we think we are tasting things, we are really smelling them. All food flavors, except sweet, sour, salt, and bitter, are smells instead of tastes. This is why even the most tasty food loses most of its "taste" when a cold in the head blocks the passage from the nose to the throat.



© Russell

Sir Henry Hallett Dale helped to find out what makes muscles move

A stimulus travels to the central nervous system from a sense organ over the nerve fiber which connects the two stations. These incoming fibers are thus known as sensory nerve fibers. When the stimulus reaches the brain, the same thing happens that happens to you when you get off a train and are greeted by someone who knows you. The stimulus is recognized.

You have learned that the word *stimulus* means something that causes action. When an incoming stimulus, or impulse from a sense organ, reaches the central nervous system, it is immediately switched to outgoing nerve fibers.

These fibers connect with the muscles that can act in response to the stimulus. As the outgoing fibers carry the messages which cause the muscles to move, they are called motor nerve fibers.

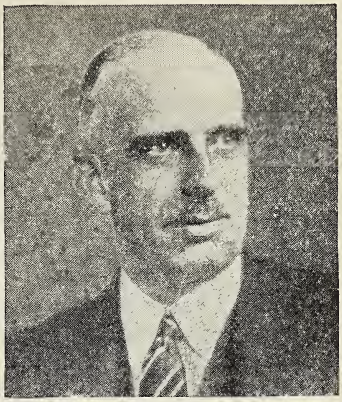
The Nobel prize in medicine and physiology for 1936 was given to two scientists, Sir Henry Hallett Dale and Dr. Otto Loewi, for their work in explaining how the motor nerves make the muscles move. When it is necessary for a muscle to move, a very minute amount of a certain substance is spurted into the muscle from the ends of the motor nerve fibers which run to the muscle. The release of this substance makes the muscle move.

The Reflexes

You know that you do many things without thinking about them. A tickle in the throat makes you cough; a speck of dust in the eye makes you wink; touching a hot stove by accident makes you draw your hand away instantly. The automatic movement made by a voluntary muscle when a sense organ is stimulated is called a reflex. The voluntary muscles are the muscles that help you to perform all your voluntary, or willing, acts.

The pathway for a reflex is formed in the central nervous system by the lacing together of the fibers of a sensory cell, a central cell, and a motor cell. A hookup is thus formed between the sensory cell and the motor cell. The stimulus from a sense organ travels over the sensory nerve fiber to its cell in the central nervous system. There the stimulus passes through the hookup to the motor nerve cell. A clear track is thus formed from a sense organ to a muscle. The thinking part of the brain does not have to work any switches to connect an incoming track with an outgoing track, because the connection is already made.

Pathways for many reflexes were already formed when you were born. When you were a little baby, you cried, you sneezed, you blinked your eyes, the instant something happened to make you cry or sneeze or blink. Other permanent pathways were formed as you grew older. When you learned to walk, your brain was very busy switching stimuli from sensory nerve cells to motor nerve cells. But as soon as those connections were established, your brain no longer had to work the switches. The act of walking had become a form of reflex action. The same thing happened when you were learning to dress yourself. Should you ever get to school on time if every morning you had to learn how to dress yourself?



Dr. C. M. Hincks
Canadian worker for mental hygiene

Habits

Another factor in habit formation is the law of effect. We tend to repeat things that give us pleasure and to avoid things that cause us pain. Dr. C. M. Hincks of the Canadian National Committee for Mental Hygiene tells us that habits once formed are hard to break, and so it is important to form only good habits. One way to get rid of a bad habit is to cultivate a good one.

REST FOR THE NERVOUS SYSTEM

What is the busiest place you have ever been in? Have you ever mailed a package at Christmas time in a city post office? Have you ever seen a traffic jam on a busy

street? The bustle that goes on in the nervous system during all our waking hours would, by comparison, make the activity in the busy street of a great city seem like the working of a child's toy. No wonder, then, that the nerve cells must have rest. The time when we are asleep is the time during which they get rid of worn-out parts and refresh themselves with new food materials for the next day's work. The centres which control the heart and breathing never sleep, it is true, but the parts of the brain which control all our conscious activities cannot go on indefinitely without complete rest. People who have been unable to sleep for a long time actually go to sleep "standing up." The average person spends about a third of his life in sleep.

Planning Your Sleep

Public-school pupils need at least from ten to eleven hours of sleep each night in order to grow properly and to feel rested and cheerful at the beginning of a new day. Since the invention of electric lights, motion pictures, and the radio have made possible so many pleasant evening amusements, it is necessary, more than ever before, for people to plan to get enough sleep. Work out the time you must go to bed in order to get the amount of sleep you need. When you have fixed the hour, stick to it and do not allow anything to interfere with it. Make going to bed on time your own responsibility.

Think of sleep as a harbor in which you moor your body for the night. All ships must slow down before they come into port. It is a good plan to spend the last half-hour before going to bed in quiet activities. Active games and hard study just before bedtime may excite a person so much that he finds it hard to go to sleep when he gets into bed.

Galloway

A great many more things go on in your brain every second that you are awake than are going on in this busy street

THE HEALTH OF THE MIND

It is only since the beginning of the twentieth century that the health of the mind, or mental hygiene, has become a science. Before that time little or no effort was made to find out why some people became insane, or "lost their minds." Long after the notion that diseases of the body are caused by demons had been given up, the idea still persisted that insane people were possessed by devils.

We now think of insanity as an illness of the mind which can often be prevented or cured, just as it is often possible to prevent or to cure an illness of the body. In many communities we have mental-hygiene clinics, where doctors are helping people to adjust the behavior problems which may lead to mental illness. In hospitals for the mentally ill the patients are treated kindly and everything possible is done to find out why they are ill and to make them well.

Scientists do not know what causes many of the diseases of the mind, but, in general, they agree that serious mental troubles are most often found in people who cannot adjust themselves to the world around them. There is no human being who goes through life without having troubles and disappointments and defeats. These are real things which must be faced by everyone. It takes courage to face them. Some people try to run away from their problems by living in a world of daydreams or by cheating or lying. Such people are said to be trying to escape reality. When they cannot escape, when they see worse troubles closing in on them than the ones they were afraid to face, they may lose their mental balance.

The boys and girls who look at things exactly as they are and make the best of them are the ones who will go through life in harmony with themselves and their fellows. The boy who marches into an examination which he fears and does the best he can is practising good mental hygiene. The girl who is able to see that she is unpopular because of some fault of her own, rather than because everyone "picks on" her, and sets out courageously to correct that fault is practising good mental hygiene. Boys and girls who realize that getting along with all sorts of people is one of the requirements of successful living will practise mental hygiene by making every effort to get

A pleasant occupation often helps to improve the outlook on life of a patient in a hospital for those who are mentally ill

From *All the Children*

The ability to play a musical instrument
gives many people great pleasure all through life

along with people. They will find all sorts of people to practise getting along with at home and in school.

One of the best ways to achieve good mental health is to have interests and activities which give one an opportunity to express one's self happily and constructively. Everyone is obliged to do many things. Boys or girls have school and home duties that are required of them. Grown-up people must work to keep the home running. But not all of the day nor every day is taken up with what one *has* to do.

Do you have a hobby? Do you like to make things, collect things, write stories, draw pictures, take photographs, or play a musical instrument in your spare time? If there is anything you like doing better than anything else you can think of, and if you give yourself time to do it, you are well started on the way toward good mental health.

ARE YOU DOING YOUR BEST TO GIVE YOUR NERVOUS SYSTEM ENOUGH REST?

Are you getting the amount of sleep that you need each night? No

Do you rest or read a book or play quiet games during the last half-hour before bedtime? I go to Study.

Do you open your bedroom window, top and bottom, each night before getting into bed? Each Night in winter

Do you make sure that the sheets and blankets on your bed are drawn smooth before you get into it? No time to

Do you make your bedroom as dark and as quiet as possible? Impossible

Do you have a hobby for your leisure time?

We dont get any Leisure Time.

1. Complete the following sentences by supplying the missing words. (*Do not write in the book.*)

a. In comparing a telephone system and the nervous system, the telephone transmitter is a __?__ organ, the telephone wires are __?__, and the telephone receivers are the __?__.

b. The message sent over the wires is called a __?__.

c. The central switchboard of the nervous system is the __?__ and __?__ __?__.

d. A hookup in the central switchboard between incoming and outgoing wires forms the pathway of a __?__.

e. When an incoming message must be referred to headquarters before it can be sent to the proper receivers, it is handled by the __?__.

2. Which of the following statements are true and which are false? Reword the false statements to make them true. (*Do not write in the book.*)

a. A stimulus is something which makes a person feel very sleepy.

b. The nerve fibers which carry messages from the sense organs to the brain or spinal cord are called motor nerve fibers.

c. The simplest response to a stimulus is called a reflex.

d. Gray matter is made up of nerve cells. ____ ____ ____ ____

e. Habits once formed are easily broken.

f. People who are mentally ill may be cured with proper treatment.

g. A twelve-year-old boy needs eight hours of sleep each night.

h. Hard exercise or study just before bedtime makes us go to sleep quickly.

i. Having a regular bedtime is a good sleep habit to form.

j. Sir Henry Hallett Dale got the Nobel prize for his work in mental hygiene.

k. We should try to get along with everyone we meet, whether at home, at school, or at play.

l. It is a good habit to spend leisure time in idleness.

m. Self-expression means talking at every opportunity.

n. Making the best of things is the same as "looking on the sunny side of life."

o. The best rewards always go to the winner.

THINK ABOUT THESE QUESTIONS

1. Observe little children who are learning to dress and undress, to use table implements, to write, to read, and to add. Why can you do these things so much more quickly and easily?

2. Why is it dangerous for little children to play with matches and why may Boy Scouts and Girl Guides be trusted to use matches in building a fire on a camping trip?

When you are walking along a country highway crowded with automobiles coming and going, which sense organs co-operate with your leg muscles to help in keeping you safe? What knowledge about crossing a street do you possess which the thinking part of your brain can use to make you a safe walker?

DO THESE THINGS

1. Using salt, sugar, vinegar, and a bitter substance, try to find out which part of the tongue is most sensitive to each taste. You must allow the substance to dissolve in performing this experiment, as things can be tasted only in solution. You can test this statement by wiping the tongue dry and then putting a sugar crystal on the tip of the tongue. Can you taste it at first?

2. How many hours of sleep do you need? Keep a record for one week of the hours of sleep you get each night. How does your record compare with the amount of sleep needed by a boy or girl of your age?

3. Many beautiful poems have been written in praise of sleep. With your teacher's help make a collection of such poems. Plan a classroom or assembly program on the subject of sleep. Poems on sleep may be read or recited and lullabies sung.

4. Compare the evening activities of boys and girls in pioneer days with the evening activities of boys and girls today. What has made the chief difference between the two? Why must we now plan in order to get enough sleep?

UNIT XII

Seeing and Hearing

We learn about the outside world mostly through our eyes and ears. Of all our five senses they are the ones that we could least easily get along without, and yet they are the ones that can most easily be harmed by improper care.

DO YOU KNOW

Why we cannot see in the dark?

Where tears come from?

How we see?

The purpose of glasses?

If swimming pools are always safe?

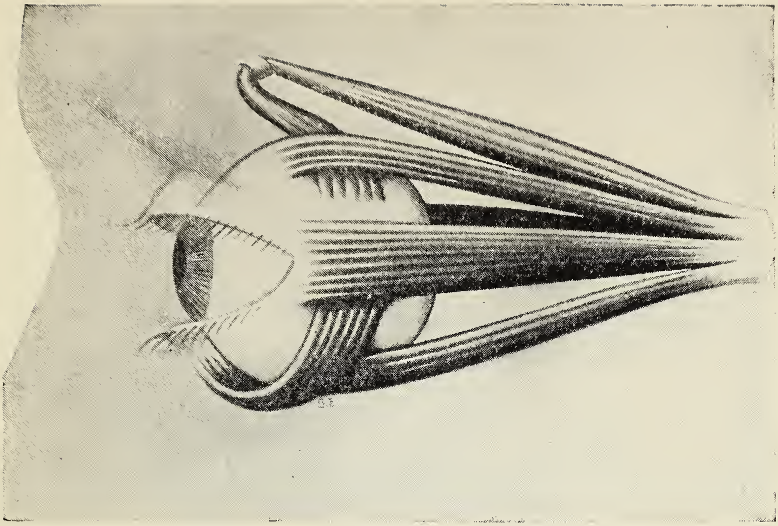
Why the ears sometimes "pop" when we go up or down in an elevator?

HOW THE EYES WORK

Can you see in the dark? You have eyes in the dark; objects are there to be seen. Why can't you see them? The eyes and light together give us the blessing of sight.

The eye is one of the most delicate organs in the body, and yet it must lie on the surface of the body in order to catch rays of light. However, everything possible is done to protect it from things in the outside world which might harm it. First of all the eye fits snugly into a bony cavity, or socket, called the orbit. It is cushioned on a bed, or layer, of fat on which it can rotate, or turn freely. It has shutters, called eyelids, which cover the eyes during sleep and close instantly when anything threatens the eye. The upper border of the eye socket is padded with a cushion of hair called the eyebrow. The eyelids are fringed with lashes, which protect the eyes from dust and which also serve to turn away the perspiration, or moisture, shed by the skin.

You may think of tears only as the drops of fluid which flow down your cheeks when you cry or when your eyes have been irritated. But your eyes are constantly bathed with tears. They are nature's "eyewash." They keep the eyes moist and wash out dust and germs. The tears are secreted by the lachrymal, or tear, gland, which is located in the upper and outer part of each eye. The tear gland is oval-shaped and about the size of a small almond. Fluid flows from it in a slow stream across the eyeball, and runs out through two tiny holes at the inner corner of the eye into a duct which leads into the nose. Crying or irritation of the eyes increases the flow of tears. The overflow spills down your cheeks and also drains into your nose. This is why you have to wipe your nose as well as your eyes when you cry.



The eye is held and turned in its socket by the rectus muscles

The eyeball is held and turned in its socket by six muscles, called the rectus muscles. These muscles make it possible to turn the eyes in all directions. Usually the muscles of both eyes work closely together. When they do not, cross-eye is the result.

What the Eye Is Like

If you will study the picture of the eye on page 227, you will see that the eyeball has three coats. The outer coat is a tough, protective membrane—the "white of the eye." There is a round opening in this coat, in the centre of the front part of the eyeball. A transparent bulging window is set into this opening, much as a watch crystal is fitted into a watchcase. Point this out on the diagram.

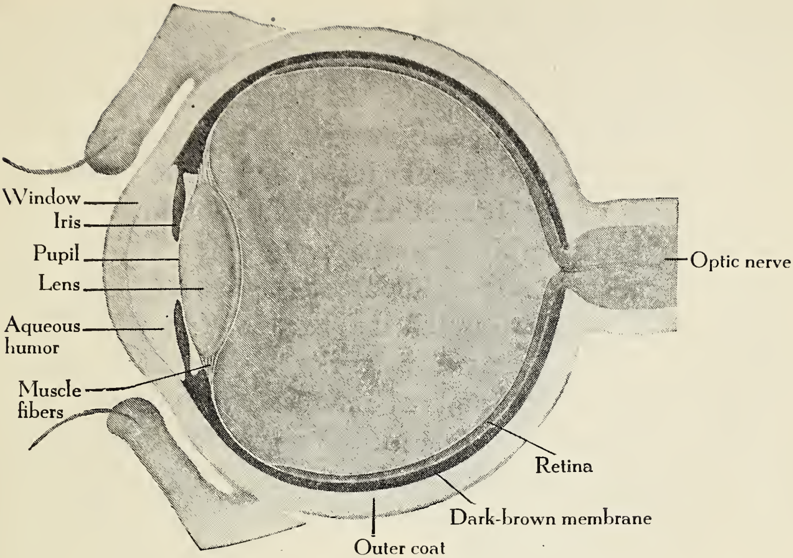
The outer coat is lined on the inside with a very thin membrane which is dark brown and which contains blood

vessels. It darkens the inside of the eye much as the inside of a camera is darkened. It also forms the base for the third and inner coat of the eye. This is the retina, the only part of the eye which is sensitive to light.

Have you brown eyes, blue eyes, or gray eyes? A round colored curtain hanging behind the front window of the eye gives your eyes their color. This curtain is called the iris. In the centre of the iris is a round hole known as the pupil. It is through the pupil that light enters the eye. Muscles in the iris draw the pupil closer together or farther apart, thus changing its size. In a bright light the pupil is small; in a dim light it is large. Do you know why?

Just behind the pupil of the eye the lens is placed. It has the same purpose as the lens of a camera. That is, it focuses rays of light on the light-sensitive retina, just as a camera lens focuses light rays on the light-sensitive film. To focus a camera lens we move it forward or backward, according to the distance from the camera of the object being photographed. It would be very awkward, however, if we had to move our eyes nearer to an object or farther away from it every time we wanted to look at it. To overcome this difficulty the lens of the eye is made of a soft jelly-like substance that can bulge out or flatten, according to the distance from us of the object we wish to look at.

In the normal eye the front curve of the window, the curve of the lens, and the size of the eyeball are just right for focusing on the retina the image of an object twenty feet or more away. To look at objects less than twenty feet distant the front curve of the lens must be made to bulge forward, or made rounder. To do this a ring of muscle fibers encircling the lens, under voluntary control, tightens, or contracts. When we look at far objects, the muscle fibers relax, and the lens flattens out.



A cross-section drawing of the eye.
Find each part of the eye as you read about it

" "

The increase in the front curve of the lens by the contraction of the lens muscle is called accommodation. The important thing to remember about it is that the muscle is working when we look at near-by objects and resting when we look at distant objects. For this reason the eyes get tired when they are used too long in reading, sewing, or other close work. We can give them a rest now and then by looking off into the distance.

How We See

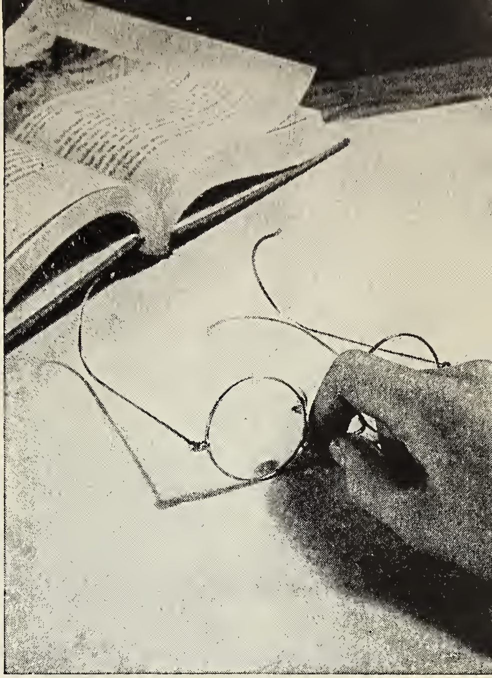
When we look at an object, rays of light reflected from it are gathered together by the window. These light rays then pass through the pupil and are focused, or bent, by the lens so that they strike the retina at a single point.

The light rays make the picture of the object on the retina. All that has happened so far is what an ordinary camera can do. The object has had its picture taken by the eye. If it were not for the brain, we should have no more idea of what this picture looks like than has the camera of the picture it takes. The retina is thickly dotted with endings of nerve fibers which are sensitive to light. These nerve fibers are collected into a single nerve, known as the optic nerve, which passes out of the back of the eyeball to the brain. The optic nerve carries to the sight centre in the brain the thousands of impulses which correspond to the picture of the object on the retina. It is the brain that "develops" the picture for us and tells us what it means. So really we see with the brain.

HELPING THE EYES TO DO GOOD WORK

In order to know just how much light we need to see clearly what we are looking at, we must consider the conditions under which the eyes are being used. For example, the amount of light necessary in a dining-room to tell the difference between knives and forks or a plate and a glass is less than the amount of light needed for reading, studying, writing, or sewing.

In addition to the amount of light we must think also of the direction of the light and the position of the body in relation to the source of the light. The light should fall from above on your work and not into your eyes. You should also make sure that the shadow of your body or hand does not fall on the book as you read or on the paper as you write. Close work should be held from fourteen to sixteen inches from the eyes, as the muscles of accommodation can adjust the lenses for close work most easily at this distance.



What has the owner of
these glasses learned
about their care?

For reading in bed the body should be propped up so that the page is at or below the level of the eyes. When you are sick or getting well from an illness, your eyes should be used as little as possible for close work. The eyes, as well as the body of which they are a part, need rest during or immediately after an illness.

Why Some People Need Glasses

The normal eye is round in shape, and the curve of its window and its lens is exactly right for focusing light rays on the retina. However, a great many people have eye defects which interfere with the proper focus. Most of these defects may be corrected by wearing properly fitted glasses.

Uncorrected eye defects make the muscles of accommodation work much harder than they do when vision is normal. Eyestrain is the result. It sometimes happens that boys and girls who are poor in their schoolwork and who get cross or tired easily are found to be suffering from eyestrain. With properly fitted glasses they improve rapidly.

People who wear glasses should know how to take care of them. To look out at the world through dirty glasses is like looking at the world through dirty windows. As

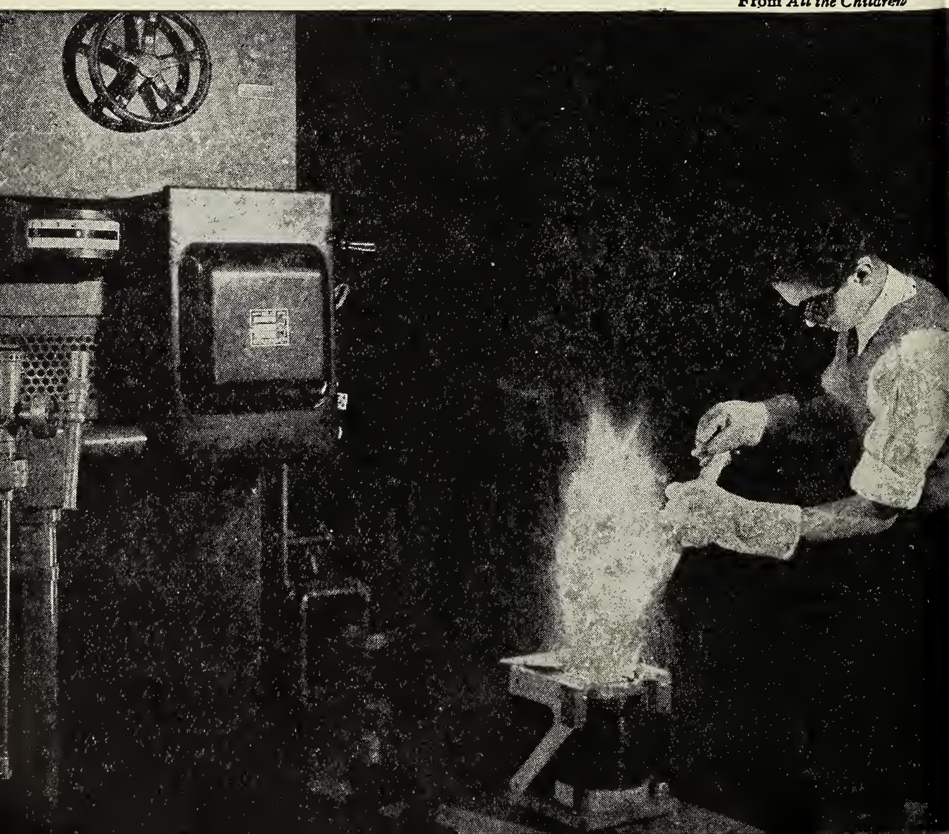
the lenses are easily scratched, glasses should be kept in a case when not in use or placed with the bows or nosepiece down so that the lenses will not come in contact with another surface. Sometimes people keep on wearing glasses after the original defect for which they were prescribed has been corrected or after the eyes have changed so much that they need different help. For this reason people who wear glasses should have their eyes re-examined at regular times.

How to Avoid Eye Infections and Eye Accidents

Eye trouble may be caused by disease either in the eyes themselves or in other parts of the body, as well as

What important safety lesson has this vocational-high-school student learned?

From *All the Children*



by uncorrected defects in the structure of the eyes or by improper use of the eyes. Some eye diseases, such as pinkeye,—that is, inflammation, or redness, of the lining of the eyelids,—are caused by germs which can be passed from one person to another. To protect the eyes from germs everyone should form the habit of keeping his fingers and soiled handkerchiefs away from his eyes. In washing the eyelids and around the eyes only a clean individual washcloth and towel should be used. People whose eyes become inflamed and sore should never try to treat this condition themselves by using advertised eyewashes or ointments. Very often a physician is able to clear up an eye disease before it causes permanent damage to the eyesight, if he is consulted early enough.

Almost everyone gets "something in his eye" occasionally. When this happens to you, do not rub your eye, as this makes matters worse. Attempts to remove the bit of dust or cinder with anything rough or unclean may cause a serious eye infection. First, give the tears a chance to wash out the particle. If this does not work, go to a doctor or nurse or to someone else who has been trained to give this form of first aid.

Although the eyes are well protected in the bony sockets in which they lie, they are easily injured by explosions of fireworks, chemicals, extremely bright lights, flying dust, bits of stone and steel, and sharp-pointed instruments. Workers who are exposed to dangers of this kind usually wear unbreakable-glass goggles to protect the eyes. Boys and girls who must use sharp-pointed tools, such as knives and scissors, in their work or play should learn how to use such instruments skilfully in order to avoid eye accidents.

The delicate eye is placed high up in the tower of the body where waves of light may fall upon it and give us sight. But in darkness, as well as in light, waves of sound beat in the air around us and give us hearing. What makes these waves? If you throw a pebble into a pool, the water is disturbed, and ripples spread out from the point of disturbance in wider and wider circles until at last they reach the shore. Just so, if you strike a gong or blow a whistle, the air is disturbed, and waves of sound spread out from the point of disturbance in wider and wider circles until at last they reach the ear.

The Instrument of Hearing

In order to hear sounds we must have a delicate instrument connected with the air and yet so firmly based that it cannot be disturbed by jars or hurt by blows. The human ear is such an instrument. The part of the ear that we see and wash is only a cuplike body to scoop up sound waves. The part that makes it possible for us to hear is placed deep in the bone of the skull. There is indeed more to the ear than meets the eye. The ear itself does not hear any more than the eye itself sees. The ear is merely an instrument on which sound waves play and thereby send impulses to a certain area in the brain called the centre of hearing. We "hear" as well as "see" with the brain.

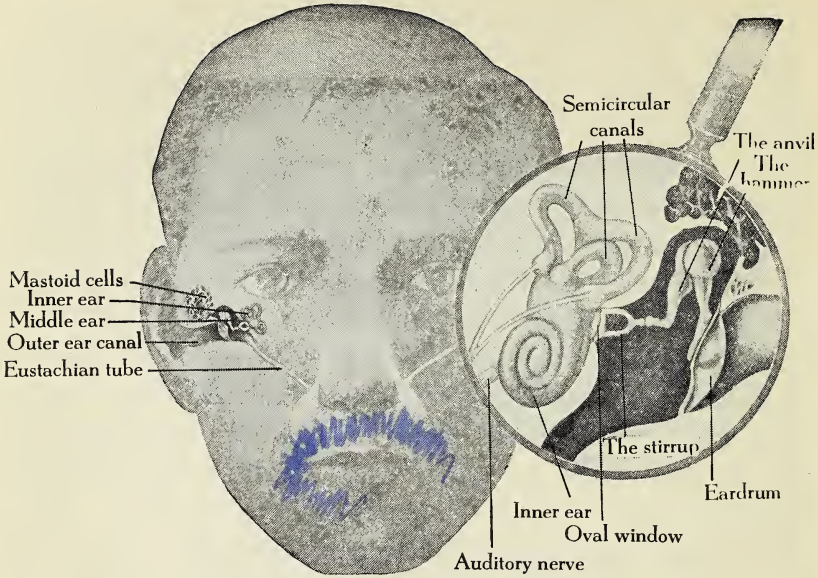
Sound waves travel through three compartments in the ear, called the outer ear, the middle ear, and the inner ear. On entering the ear the sound waves run slantwise down a short narrow winding passage called the ear canal. The walls of this canal are lined with hairs and secrete a thick

yellow wax. The hairs and the wax are useful in catching dust and insects which might otherwise injure the inside of the ear. The part of the ear you see and the ear canal are called the outer ear.

At its inner end the ear canal is completely closed by a tightly stretched sensitive membrane called the eardrum. Beyond the eardrum is a small irregular space, or chamber, which is known as the middle ear. In this chamber, on the wall opposite the eardrum, is a small hole called the oval window. This window is covered over with another thin membrane like the eardrum. The oval window leads into a second chamber called the inner ear. Bridging the gap in the middle ear between the eardrum and the oval window are three minute bones locked together. From their shape they are called the hammer, the anvil, and the stirrup. Find these on the diagram. The handle of the hammer is attached to the eardrum and its head to the anvil. The anvil in turn connects with the stirrup, which is attached to the membrane covering the oval window.

The middle ear, across which this tiny bridge of bones is thrown, is not completely cut off from the outside world. It is connected with the throat by a tube called the Eustachian tube. It communicates also with the mastoid cells, or air cells, in the bone behind the ear.

Through the Eustachian tube air enters the middle ear in order to make the pressure of air equal on both sides of the eardrum. The tube is closed when we are breathing quietly, but it opens when we swallow, talk, or take a deep breath as we do in yawning. Air pressure on the earth increases or decreases according to the distance up or down from the surface of the earth. If we are used to the air pressure of a certain place on the earth's surface and we move for some distance up or down from this place, our eardrums tell us instantly when the air pressure



A diagram showing the location and inside structure of the ear. Find the different parts of the ear as you read about them

has changed. In riding through a deep tunnel (such as one beneath a river) or in going down into a mine far under the earth's surface, the air pressure on the outside of the eardrum increases and drives the drum in. We then have a peculiar feeling in the ears. If we swallow or yawn, the Eustachian tube opens and air of the same pressure as that which is pressing on the outside of the drum enters the middle ear. The drum then flops back to its normal position. When we go up in an elevator or an airplane, the air pressure on the outside of the eardrum grows less and the drum bulges out. Again swallowing or yawning makes the pressure equal on both sides of the drum. The stuffy dull feeling in the ears which comes when we are suffering from a cold in the head or when we have an enlarged adenoid is caused by the blocking of the Eustachian tube.

The thin membrane covering the oval window is made up of strands, or strings, each one of which is of a different length, like the wires of a tiny piano. Seated on each string is a row of cells which connect with nerve fibers. These fibers are gathered together into a single nerve called the auditory, or hearing, nerve, which runs from the inner ear to the hearing centre of the brain.

How We Hear

What happens when we hear? Sound waves make the eardrum vibrate, or shake. This vibration is picked up by the three tiny bones of the middle ear and carried across to the membrane stretched over the oval window. When this membrane starts to vibrate, the fluid in the lower part of the inner ear is thrown into motion. The sound waves are thus transformed into tiny waves of water which beat upon the strings of the membrane enclosed. Each wave beats, or vibrates, at a certain rate per second, and each strand, or string, is tuned to a single rate of vibration. The vibration of a string stimulates the row of sensitive nerve cells seated on the string. These nerve cells send to the brain by way of the auditory nerve the impulses which correspond to the sound which made the string vibrate. When these impulses reach the hearing centre of the brain, the sound is recognized.

The upper part of the inner ear is made up of three tiny tubes semicircular in shape and called the semicircular canals. They contain fluid, like the rest of the inner ear. When we move our heads, the fluid in one or the other of the canals is set in motion. This motion sends information to the brain which makes us conscious of the movements of the head. If the fluid in the canals is thrown into confusion, as happens when we turn around fast or when

we are on a ship or in an airplane which plunges now this way and now that, we may become dizzy and stagger or even feel seasick.

HELPING THE EARS TO DO GOOD WORK

A great many people lose part or all of their hearing as a result of ear trouble. Examinations of school children show that nearly four out of every ten have some loss of hearing. It is a great handicap not to be able to hear well. Many boys and girls who were thought to be dull or stupid have been found to be hard of hearing. Failure to hear well may keep a person from getting a job he wants. It may also cause him to become involved in an accident. Hardness of hearing often develops so slowly that a person who suffers from it does not know that he cannot hear as well as he should.

A machine called the audiometer is now used in many schools to test the hearing of boys and girls. As many as forty students can be tested at one time. If even a slight loss of hearing is discovered, a physician should be consulted at once. The physician may help to prevent further loss of hearing if his directions are followed carefully. If possible, the ears should be examined and tested each year.

Protecting the Ears from Harm

The carefully guarded inner ear is seldom seriously damaged. Most ear troubles come from infections which reach the middle ear through the Eustachian tube. A bad head cold, sinus disease, tonsillitis, grippe, measles, scarlet fever, or diphtheria may lead to an abscess,

Why do people sometimes become seasick in a boat on the ocean?

or the formation of pus, in the middle ear. Pus pressing on the eardrum causes the ear to ache. If the pressure is great, the eardrum will break and pus will run out of the ear canal. The injury to the eardrum may result in loss of hearing. In case of earache a physician should be consulted at once. It is a great mistake to try to cure the ache with home medicines or to wait until the eardrum breaks. If you go to the doctor soon enough, he may be able to prevent permanent injury to the eardrum. He will also take steps which will help to prevent serious trouble, such as the forcing of pus up into the mastoid bone. This causes a disease called mastoiditis. In order to let the pus out of the mastoid bone an operation may be necessary.

Repeated colds, diseased or enlarged tonsils, and long-continued sinus trouble may so irritate the membrane lining of the middle ear that it becomes thickened and the three tiny bones bridging it get stiff in the joints. Then sound waves are not carried readily from the eardrum to the inner ear, and loss of hearing results. This is the type of ear trouble which is most common. It causes queer head noises, a full or stuffy feeling in the ears, and dulled hearing. People who have this kind of ear trouble ask to have sentences repeated and often fail to answer when they are asked questions. If you have any of these symptoms, ask your parents to take you to a physician for an ear examination. If the condition is not cleared up in its early stages, it may cause permanent loss of hearing.

Temporary loss of hearing may result when wax in the outer ear canal forms into a hard ball and plugs, or stops up, the canal. Hearing returns when the wax is removed. Sometimes people try to remove hardened wax or other objects by poking into the ear canal with hairpins, toothpicks, or other homemade instruments. To do this may injure the lining of the canal or even the delicate eardrum

Roberts

This boy has learned to breathe properly
while swimming the crawl stroke—
in through the mouth while the face is out of water,
out through the nose under water

itself. A physician should be asked to remove any object in the ear canal which is beyond the reach of the middle finger. A wise saying states, "Nothing smaller than the elbow should ever be put into the ear."

Swimming and diving also may lead to ear trouble. The water may carry germs into the nose or throat, then into the Eustachian tube, and finally into the middle ear. By learning to breathe properly while swimming you can keep water out of the Eustachian tube. A beginning swimmer should always ask a good swimmer to show him how to breathe while practising the different strokes.

ARE YOU DOING YOUR BEST TO PROTECT THE WONDERFUL GIFTS OF SIGHT AND HEARING?

When you do close work, such as reading, sewing, and writing, do you hold the work about fourteen inches from your eyes?

Do you look into the distance occasionally to rest your eyes?

Do you make sure that the light is coming from above when you do close work? Is the light always bright enough?

Do you prop yourself up in a sitting position when you read in bed or on a couch or sofa?

When your eyes or ears trouble you in any way, do you ask your parents to take you to a doctor?

Do you use only your own washcloth and towel in washing your face?

Do you refrain from rubbing your eyes or poking into your ears?

If you wear glasses, do you keep them clean and protect the lenses from scratches?

Do you swim only in water that you know is not polluted?

Do you breathe properly when swimming?

Do you know how to protect your eyes from injury when you are working with sharp-pointed tools?

Are you using the knowledge you have gained about the prevention of colds?

TRY THIS TEST

Select the word or phrase which best completes each incomplete sentence. (*Do not write in the book.*)

a. The only part of the eye which is sensitive to light is the (1) pupil · (2) retina · (3) white.

b. Light enters the eye through an opening called the · (1) pupil (2) lens · (3) iris.

c. An increase in the front curve of the lens of the eye · (1) rests the eye · (2) makes the muscles of accommodation work · (3) enables us to see distant objects.

d. Impulses corresponding to the picture of an object we are looking at are carried to the brain by the · (1) lens muscle · (2) optic nerve (3) dark-brown membrane.

e. Eyestrain caused by a defect in the structure of the eye may often be corrected by · (1) putting drops in the eyes · (2) wearing properly fitted glasses · (3) going to bed early.

f. The middle ear is connected with the throat by the · (1) outer ear · (2) Eustachian tube · (3) auditory nerve.

g. Nerve fibers run to the hearing centre of the brain from the (1) eardrum · (2) middle ear · (3) inner ear.

h. When a person has an earache, he should · (1) put drops in his ear · (2) take medicine to stop the pain · (3) go at once to the doctor.

i. Water may be kept out of the middle ear while swimming by (1) plugging the ear with cotton · (2) wearing a tight bathing cap (3) breathing properly.

j. Artificial light for reading should come · (1) from in front (2) from above and fall directly on the page · (3) on a level with the eyes.

k. If a child should get a pea or bean in his ear, we should · (1) try to poke it out with a toothpick · (2) take the child to a physician (3) drop oil into the ear.

THINK ABOUT THESE QUESTIONS

How recently have you had an eye examination? What does the eye specialist wish to find out when he asks you to read the letters on a chart hanging on the wall, first with one eye and then with the other? Why do the letters on the chart decrease in size from the top down?

Do you think it is a good thing to buy glasses, as some people do, without having the eyes examined by an eye specialist? What reasons do you have for the answer you have given?

DO THESE THINGS

1. Study carefully the picture of the eye given on page 227. Shut the book and make a picture of the eye from memory. Can you explain why it is that you can do this? A picture taken by a camera is developed and then printed on paper. Where are the pictures "taken" by the eye "developed and printed"?

2. Stand by a window which has a curtain of lace or net or some other material through which you can see. Can you see the pattern of the curtain clearly and the view from the window clearly at the same time? Can the eye focus simultaneously (at the same time) on near and distant objects? What change takes place in the eye when you look at near-by objects?

3. Make a study of the lighting arrangements of your classroom. What position do the desks and the blackboard in the room occupy in relation to the source of light? What are the arrangements for artificial lighting?

4. Is there anyone in the class who knows a great deal about radios? If not, perhaps a boy in one of the upper grades can explain how a radio works. You will then find it interesting to compare the ear with a radio receiver.

5. Have you ever had your hearing tested with an audiometer? Find out how this instrument works and something about its history.

6. Make a list of the occupations in which a considerable loss of hearing would be a great handicap. What are some of the occupations in which a person who is hard of hearing could succeed? Would lip reading make it possible for such a person to succeed in any of the occupations in the first list? If anyone has a slight loss of hearing without knowing it, ought he to be glad or sorry to have it discovered early in life? Why?

Is this school library properly lighted? What are the reasons for your answer

and etc....

UNIT XIII

Safety and First Aid

Accidents happen usually because someone's brain failed to give the correct signals to the muscles at a particular moment. Perhaps in an emergency someone did not know exactly what to do. Perhaps a child was doing something, such as whittling wood with a knife, which he had not yet learned to do skilfully. In order to prevent accidents everyone must store his brain with the knowledge which will help him to use good judgment, and his team of brain, muscles, and bones must have plenty of experience in working together smoothly and skilfully.

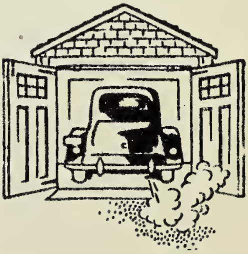
DO YOU KNOW

How to treat a burn?

How to rescue a victim of electric shock?

What to do when someone has swallowed a poison?

Why the garage door should always remain wide open when the automobile engine is running?



How to give artificial respiration?

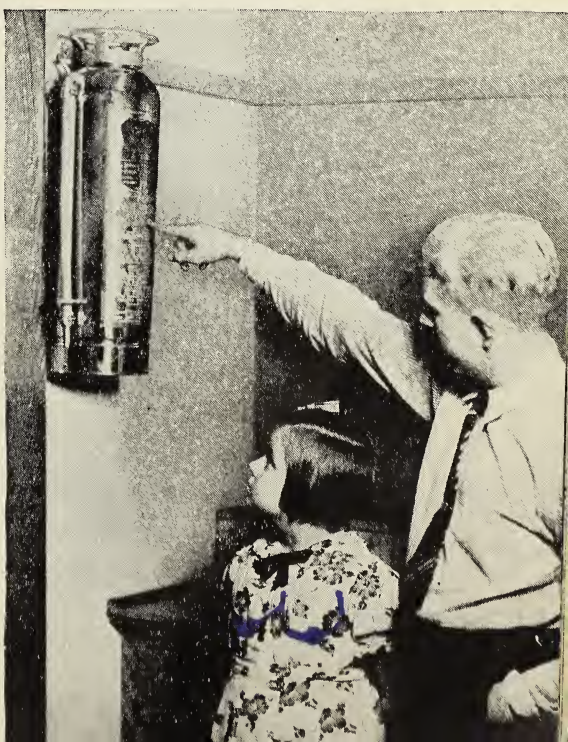
Why broken glass should never be thrown into a waste basket?

How to stop bleeding from an artery?

Once in a while a boy or girl must take charge when someone is hurt in an accident. A person who keeps his head and knows what to do may often prevent further injury or even loss of life.

Getting a doctor speedily is very important when a serious accident occurs. Post in a place near the telephone in your home the name and telephone number of your family physician so that he can be called without delay. If the doctor is not at home, the quickest way to get help is to ask the police department to send an ambulance. Any policeman or telephone operator will call an ambulance for you. Be sure to give the correct address of the place where the ambulance is to come. The ambulance will arrive quickly, as it has the right of way over other vehicles. If you live in the city you have often seen the police hold up traffic for an ambulance with its clanging bell as it hastens to or from the scene of an accident.

While you are waiting for the doctor or the ambulance you should keep the injured person warm and as comfortable as possible. If the accident has occurred outdoors and a crowd gathers, ask everyone to stand back for the greater comfort of the victim. See



Everyone in the home ought to know where the fire-extinguisher is located

that he has plenty of air. Examine him carefully to find out the extent of his injuries, but *do not move him* any more than is absolutely necessary to give first aid. This is especially important if any bones are broken. Severe bleeding, stoppage of breathing, and poisoning must have *immediate treatment*. On the next pages you will learn how to give these forms of first aid.

Shock is present in almost all serious injuries and in many slight ones. It is shown by paleness, rapid pulse, sweating, thirst, and feeble, shallow breathing. The patient may be partly or totally unconscious. After giving the first-aid treatment necessary to save a person's life, you may need to treat him for shock unless the doctor has arrived.

In case of shock place the patient on his back with his head lower than his body unless his head has been injured. In cases of head injury raise the head slightly. Cover the patient with coats or blankets and apply hot-water bags or hot bricks or hot stones wrapped in cloth or newspapers. Be careful not to burn him. A light hot-water bag placed over the heart helps to stimulate the heart action. Do not give anything by the mouth unless the patient is fully conscious and can swallow without difficulty. If he is able to swallow give him a stimulating drink, such as hot coffee, hot tea, or one-half teaspoonful of aromatic spirits of ammonia in a half glassful of hot water.

First-Aid Cabinet

Another way in which you may prepare for emergencies is to have a first-aid kit in your home. Handy first-aid kits may be purchased at the drug store, or the supplies may be purchased separately if you prefer. All first-aid material and medicines should be carefully labelled and kept in a cabinet out of reach of small children.

A first-aid cabinet for home use should contain the following articles:

A clinical thermometer for taking body temperature

A small package of absorbent cotton for washing wounds

A small package of sterile gauze for wound dressings

A roll of two-inch adhesive plaster for fastening bandages

A bar of yellow kitchen soap for scrubbing the hands before dressing a wound

Scissors for cutting gauze, adhesive plaster, etc.

A hot-water bag

An ice bag

An eyecup

Boric acid (four ounces) for use in making an eyewash (one level teaspoonful in a glass of boiled water)

A tube of white vaseline or tannic-acid jelly for treating small burns

An antiseptic such as iodine, $3\frac{1}{2}$-per-cent solution (two ounces), for painting all breaks in the skin. Keep the iodine bottle tightly closed with a glass or rubber stopper to prevent evaporation. If iodine is kept too long or the bottle is not tightly sealed, the solution will become so strong that it may cause a serious burn when used.

Aromatic spirits of ammonia for use as a stimulant in faintness or shock.

First Aid for Burns and Scalds

In a first-degree burn the skin is reddened. A second-degree burn is one in which the

Galloway

The supplies in a first-aid cabinet should be neatly arranged and clearly labelled

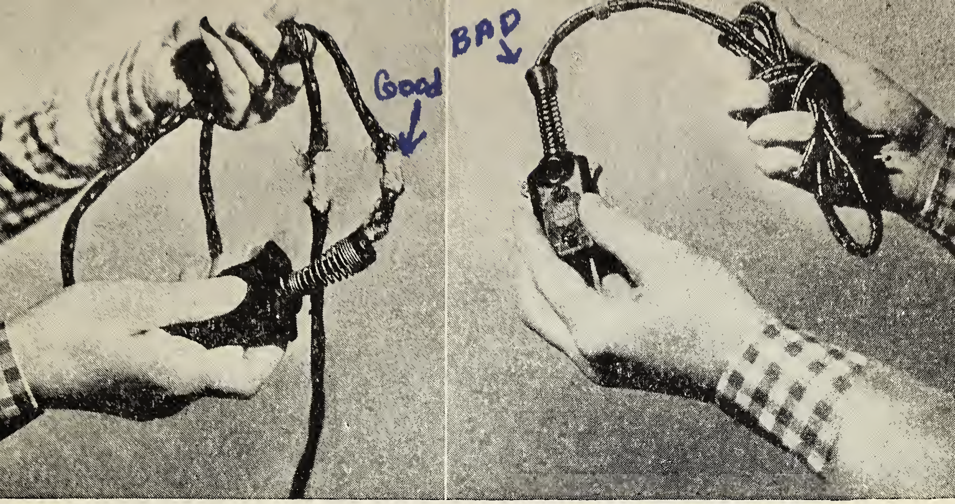
skin is blistered. A third-degree burn is one in which there is destruction of the tissues for some depth. The flesh is actually charred or cooked. Any burn is very painful and may be serious if a large portion of the body surface is involved. Deep or extensive burns should always be treated by a physician.

For a small first-degree burn in which the skin is merely reddened, a compress wet with a solution of baking soda in water or a compress soaked in a weak tannic-acid solution and covered with a bandage makes a good dressing. The dressing should be kept moist. Tannic-acid solution is made by dissolving five teaspoonfuls of tannic-acid powder in a glass of warm water. In an emergency, strong tea may be used. To relieve the pain from a first-degree burn, vaseline, tannic-acid jelly, or any clean oil or ointment may be used before applying the dressing. For second-degree or third-degree burns call a physician.

Do not put a dry bandage or any greasy substance on raw sensitive burns. The removal of anything which cannot be removed easily before a permanent dressing is put on by the doctor will cause the patient great pain. If clothing sticks to the burned place, do not try to pull it off. Leave this for the doctor to do.

Chemical burns are caused by acids, such as carbolic acid, or by alkalies, such as lye. The first-aid treatment for a chemical burn is to wash it *immediately and continuously with large quantities of water.* Then treat it in the same way as any other burn.

Powder burns from exploding firecrackers, from blank-cartridge pistols, or from fireworks or firearms of any kind should always be treated by a physician, as there is danger of tetanus from this kind of injury.



Good Housekeeping Institute

Why is it important to replace a worn-out electric cord with a new one?

PREVENTING ASPHYXIATION

Asphyxiation is caused either by the cutting off of the oxygen supply of the body because the person cannot breathe or by the breathing in of air which contains a poisonous gas. An asphyxiated person appears to be lifeless because he has stopped breathing. No one can stay alive for more than eight minutes in this condition. Four common causes of asphyxiation are electric shock, drowning, gas poisoning, and choking.

To prevent fires and electric shock care and intelligence are needed in handling the many electrical appliances which have added so much to the comfort and convenience of our homes. The manufacturers of such equipment have spent much time and money in making it safe for home use. Electric irons, toasters, heating pads, washing machines, and similar appliances are equipped with regulators and other devices which make them accident proof when ordinary care is used. *Read the directions and follow them carefully* is good advice which everyone should take seriously.

Defects in electrical equipment should be repaired only by an employee of the electric-light company or some other competent electrician. Worn-out cords should be replaced immediately in order to prevent short circuits. Always disconnect electric irons, toasters, percolators, and similar appliances on leaving a room by pulling the plug from the floor or wall socket.

One receives an electric shock if a current passes through his body from a conductor of electricity. The conductor may be a live wire or rail or a faulty electric fixture. Water is a good conductor of electricity. For this reason no electrical appliance of any description, including buttons or cords for turning electric light on or off, should ever be touched with wet hands or with a damp cloth held in the hand or while in a wet bathing suit.

To rescue a victim of electric shock, contact must at once be broken between the victim and the electrical conductor. Until this is done do not touch the victim with your bare hand, as you in turn will suffer from shock. Your hands must be protected with something that is a nonconductor of electricity. Dry leather, wool, wood, and paper are good nonconductors. Dry leather gloves, a pocketbook held open, or several thicknesses of dry wool cloth or newspaper may be used to protect the hands in dragging the victim from the electrical conductor. Or the live wire or other conductor may be removed from the victim by using a dry wooden stick. After the rescue artificial respiration must be started at once if the victim has stopped breathing (see page 255).

Gas Poisoning

Another common cause of asphyxiation is gas poisoning. It sometimes happens that food cooking in a pot or pan on a gas stove boils over and puts out the gas flame. If no one

is in the kitchen, the fact that gas is escaping may not be noticed, and people in other parts of the house, especially if they are asleep with the windows closed, may be overcome by the fumes.

Here are some good rules for the safe use of gas. Perhaps you can think of others.

Never leave a gas stove unattended when the gas is burning.

Teach small children to stay away from the gas stove. When they are old enough to understand, explain why it is dangerous to touch the burner cocks.

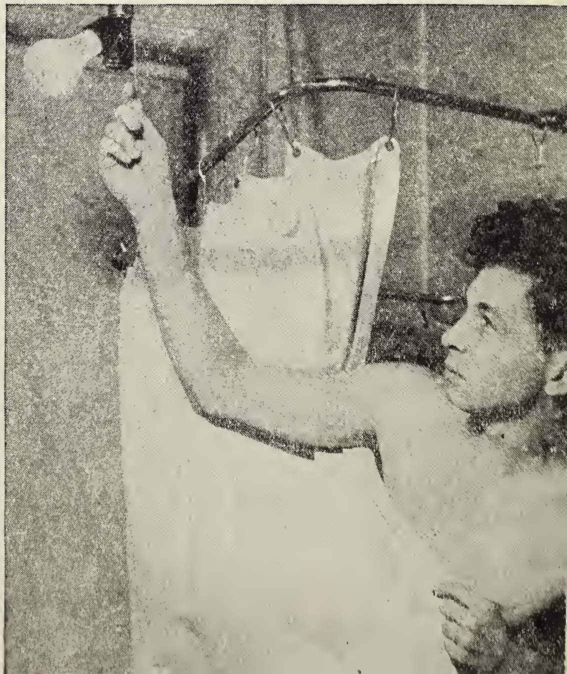
Always keep a window open in a room where gas is burning.

Keep the gas stove clean.

Have all gas appliances, such as the gas stove, gas pipes, and fixtures, repaired only by a trained man from the gas company.

The most deadly gas to guard against in the home is carbon monoxide. The dangerous thing about this gas is that it has no odor. Two per cent of carbon monoxide mixed with ordinary air is poisonous; 4 per cent is fatal. Carbon monoxide strikes swiftly and silently, and many persons are killed by it each year. It develops when common fuels such as coal, wood, gasoline, and gas do not burn completely.

If you have a gas stove in your home it should be provided with a vent or flue to carry



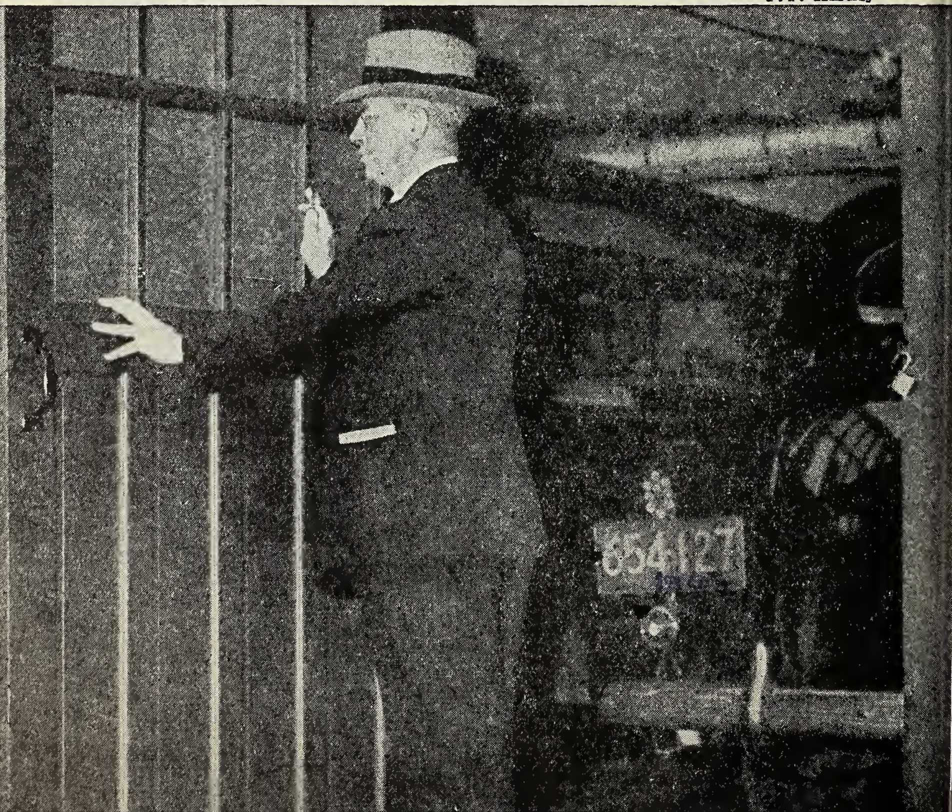
Why is this a dangerous thing to do?

away fumes which might possibly develop if the burners are not properly adjusted. Gas stoves, gas furnaces, and gas water heaters should be cleaned and inspected at regular intervals by someone from the gas company to make sure they are in good condition.

About 15 per cent of the gas discharged through an automobile exhaust pipe is carbon monoxide. This is why the air in a closed garage can be poisoned so quickly when an automobile engine is running. It is very important to make sure that the garage doors are wide open before starting an automobile and before turning off the motor when the car is returned to the garage. Every year many people die of carbon-monoxide poisoning because they did not follow this rule. If you should happen to be in an automobile with

The safe thing to do before starting an automobile. Why?

F. F. Hartley



an older person who forgets to observe this important safety precaution, you may offer to open the garage doors as a courteous reminder.

If it is ever necessary for you to rescue a person from a gas-filled room or garage, tie a wet cloth over your mouth and nose before entering. *But do not rely on this.* Fasten a rope around your waist and have someone on the outside hold the other end to drag you out in case you fall. When a victim of gas poisoning has been rescued he must be given artificial respiration immediately if he has stopped breathing (see page 255).

Choking

Little children have a habit of putting into their mouths almost anything small enough to pass their lips. Older boys and girls can protect babies and small children from accidents caused by choking on small objects, such as marbles, pebbles, and coins, by keeping such things out of children's reach.

To rescue a person who is choking because something is lodged in the throat, pass your finger into the throat and hook your finger around the object in order to remove it. When a small object such as a marble or hard candy becomes lodged at the entrance to the windpipe where it cannot be reached, it may sometimes be dislodged by slapping the victim vigorously on the back between the shoulder-blades. The victim may help by lying on his abdomen across a bed or chair with his head hanging over the side. Small children may be held upside down by the heels and shaken. If these measures do not work, get a doctor as quickly as possible. Artificial respiration must be started at once in case breathing has stopped after the object has been removed.

Immediately after rescue, steps must be taken to force air into and out of the lungs of an asphyxiated person until normal breathing is restored. If there is someone to go for help, tell him to ask the nearest police department or fire department or hospital to send an inhalator. An inhalator is a device for giving oxygen. But let nothing delay you in starting artificial respiration. The method commonly used is called the prone-pressure method.

Turn the victim over on his stomach on the ground. Extend one arm above his head. Turn his face to one side so that his nose and mouth are free for breathing, as on the opposite page.

Repeat the two movements—pressing and letting go—at the rate of your own natural breathing, that is about fifteen times a minute or once every four seconds. Pushing up against the lower ribs forces air out of the lungs and when the pressure is removed fresh air rushes into the empty air sacs.

Continue artificial respiration *without interruption* until the patient breathes naturally or until a physician says the patient is dead. When natural breathing has been restored, the patient must be kept quiet and warm. He should be given hot stimulating drinks after he has recovered consciousness.

PREVENTING CHEMICAL POISONING

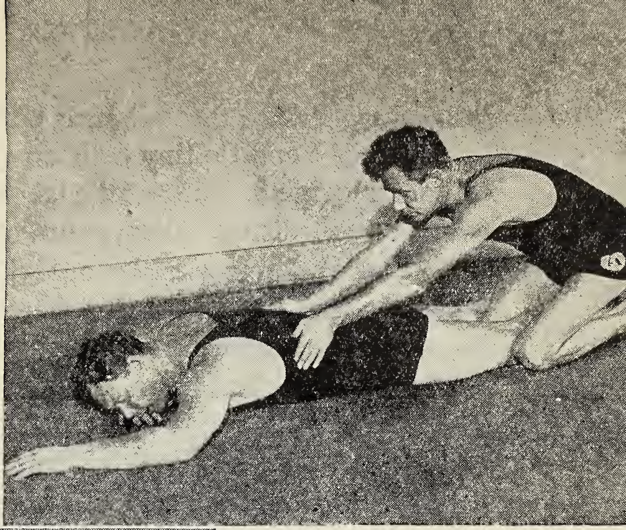
More than one fourth of the deaths caused by chemical poisons are caused by the mistaken use of poisonous drugs or overdoses of certain medicines. It is a good idea to have a shelf high up in the medicine cabinet reserved for bottles or boxes containing poisonous ″

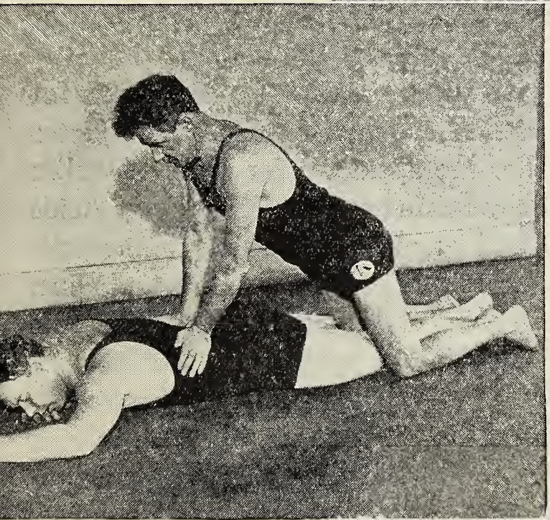
The prone-pressure method of artificial respiration

POSITION 1

AT RIGHT

Kneel with one knee between the victim's knees. Then lean forward and place your hands on the small of his back at the lower edge of the ribs





POSITION 2

AT LEFT

With your arms held straight, sway forward and bring the weight of your body upon your hands. As you are doing this, slowly count "One, two." The movement should be an upward shove or squeeze

POSITION 3

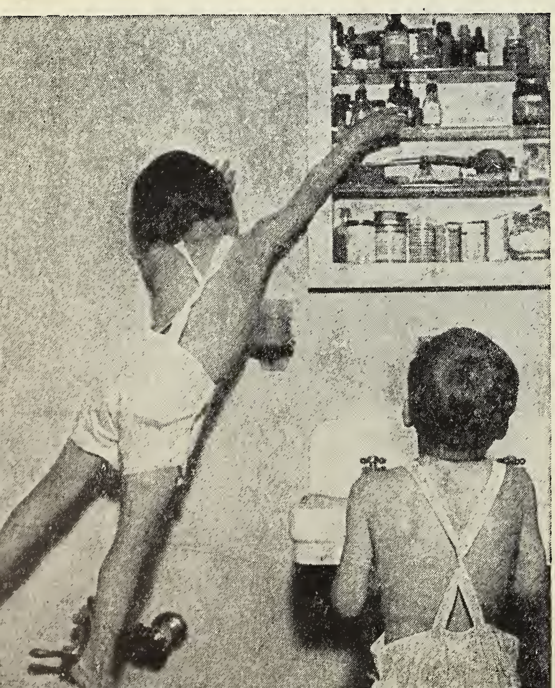
AT RIGHT

Straighten up again, removing the pressure, and as you do so count "One, two" at the same rate

drugs. Make sure that all such boxes and bottles are labelled plainly and tie tiny bells on them which will sound an added warning. Look at the label twice before giving or taking any medicine. Always turn on the light and inspect the bottle label before taking or giving a medicine at night. All household cleaning materials and disinfectants which contain poisonous substances should be labelled poison and kept on a high shelf or in a locked closet where children cannot find them.

If a person has swallowed a poison, immediate action is demanded. Call a doctor at once, and if you know what poison has been taken, tell him. Then, while waiting for the doctor to come, start at once to give first aid.

It is not necessary to learn a long list of antidotes for poisons, but remember that, in general, acids are antidotes for alkalies and alkalies are antidotes for acids. Alkalies available in the home are baking soda and soapsuds. Acids available are vinegar and lemon juice. Alcohol is the antidote for carbolic acid. Starch water is the antidote for iodine. Usually the antidote is printed on the label of any bottle or box containing a poison. Make a list of any poisonous substances kept in the home. Under the name of each substance write the antidote, and paste the list on the inside of the first-aid cabinet door.



Why is it necessary to place poisonous substances where children cannot possibly get at them?

The first thing to do when a person has taken poison is to cause vomiting. Something that causes vomiting is called an emetic. The best and safest emetic is lukewarm water taken in very large amounts. This washes out the stomach almost as well as a stomach pump and causes vomiting without too great strain. Large quantities of water also dilute the poison, and a poison greatly diluted is not likely to cause so much harm as poison in concentrated form. Remember that large amounts of water must be forced down. A little grease, mustard, or salt added to the water makes it more nauseating, but if the patient will drink quantities of plain warm water this usually is not necessary. Sirup of ipecac in teaspoonful doses also is a safe emetic, but this must be used *in addition to* and not *instead of* large quantities of water—quarts if necessary.

When the stomach is well washed out, the specific antidote should be given if this is known and is at hand, and then something should be given to soothe the irritated surfaces of the throat and stomach. Soothing substances usually available are milk, white of egg, and starch water. If the doctor has not arrived by this time and the patient seems very weak, a stimulant such as hot black coffee or aromatic spirits of ammonia in hot water should be given. Keep the patient warm.

PREVENTING AND TREATING WOUNDS

Cuts and scratches are usually caused either because a person encounters something sharp or jagged where it ought not to be or because he is handling sharp-pointed or sharp-edged instruments carelessly or unskilfully. In rummaging through a scrapbasket for a lost article a person may be cut badly if his hand encounters a piece of broken glass or crock-

ery or the jagged top of a tin can or an old razor blade. All such waste material should be placed in a special container and not with ordinary household waste.

Sometimes knives and scissors and other cutting instruments are left lying about the house or placed in drawers where other things are kept. Many people have been injured badly by sitting down on or stepping on sharp-pointed or sharp-edged tools or by encountering knives or scissors in drawers or workbaskets when they were looking for something else. Special places should be set aside for all tools, and the tools should always be returned to their places after use. Instruments such as scissors and paper-cutters, that are kept in desks or workbaskets, should have sheaths.

How to Stop Bleeding from Wounds

If bleeding from a wound is severe it must be stopped as quickly as possible or death may result. It is essential to know whether the bleeding is caused by a cut artery or a cut vein. If an artery has been cut, the blood flows out in quick spurts. If a vein has been cut, the blood flows in a steady stream. Do you know why?

Usually it is possible to stop bleeding from an artery by pressing with the thumb or fingers on a spot where the artery crosses a bone. This is called a pressure spot. The pressure must be applied at the pressure spot that is nearest to the wound and *between* the wound and the heart. In the diagram on page 260 you will see the spots where pressure should be applied in order to stop bleeding from an artery. To stop bleeding from a vein, pressure must be made at a point on the side of the wound *away* from the heart. Sometimes, if the bleeding is not severe, it may be stopped by placing a pad of sterile gauze directly over the wound.

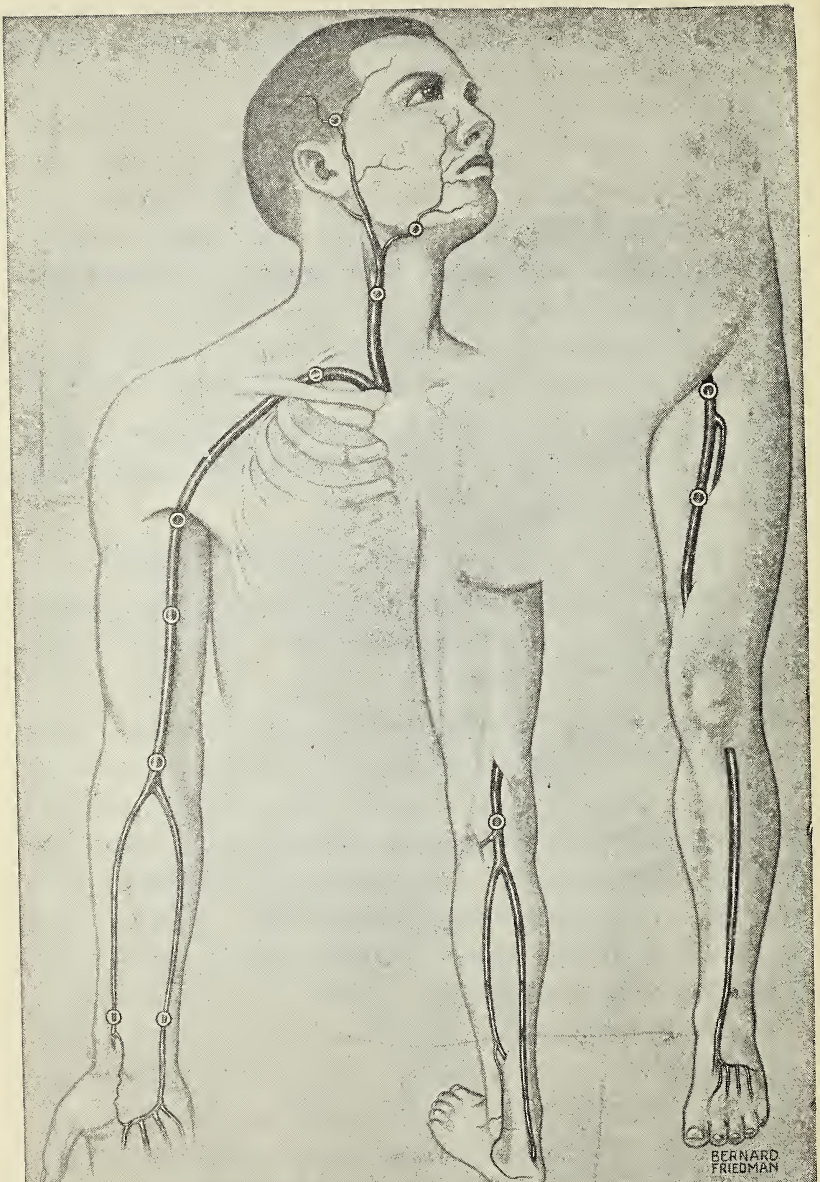
Only when pressure with the thumb or fingers or placing a compress over the wound fails to check bleeding should a tourniquet be used. To apply a tourniquet to stop bleeding from an artery, place any firm pad about the size of an egg on the pressure spot nearest to the wound between the wound and the heart (see diagram on page 260). Then tie a handkerchief, belt, strap, or any similar article over the pad, slip a small stick or pencil through the knot, and twist until the bleeding stops.

It is extremely dangerous to cut off the blood supply from any part of the body for any length of time. Many serious results, including the necessity of amputating, or cutting off, a limb, have followed the improper use of the tourniquet. Remember these rules:

1. Twist a tourniquet only hard enough to stop the bleeding.
2. Loosen the tourniquet every ten or fifteen minutes. Do not tighten it again if the bleeding has stopped but keep it in place in case the bleeding starts again.

To stop severe bleeding from wounds in places where a tourniquet cannot be applied, such as the neck, armpits, or trunk of the body, place a sterile pad or freshly laundered handkerchief over the wound and apply hand pressure over this. If sterile cloth is not available press the fingers directly over the wound and keep them there until a sterile pad can be obtained. If bleeding is controlled before the doctor's arrival, the wound should be covered with a sterile dressing.

An ordinary nosebleed usually may be stopped by pinching the nostrils firmly together for four or five minutes or by pushing a little pad of tissue paper or soft cloth under the upper lip. If these measures do not stop the bleeding in a short time, apply cloths wrung out of cold water to the back of the neck. If the bleeding is severe or continues for any length of time, a doctor should be called. While wait-



To stop bleeding from an artery, press on the pressure spot nearest to the wound and between the wound and the heart. Pressure may be applied anywhere along the artery at the front of the leg. Why?

ing for the doctor a cotton plug may be pushed gently into the nostril from which the blood is coming. After a nosebleed has been checked the clot should not be blown from the nose until all danger of a recurrence of the bleeding appears to be past.

Dressing Wounds

In general, it is best to have a physician take care of any wound which has bled severely or which has become infected or in which the skin has been much bruised, torn, or punctured. Signs of infection are redness, swelling, throbbing, pain, and the appearance of pus. However, all older boys and girls should know how to put on a clean neat surgical dressing. Great care should be taken in dressing small injuries as well as in dressing serious ones. Remember that any break in the skin no matter how small may open the way for the entrance into the body of harmful germs.

Before starting to dress a wound assemble everything you will need and then scrub your hands very thoroughly with hot water, soap, and a small handbrush and dry them on a clean towel. First wash the skin surrounding the wound, using sterile water and a sponge of sterile cotton or gauze. Wipe away from the edges of the wound to avoid washing more dirt or germs into it. Never dip the sponge into the sterile water a second time. Drop it on an open newspaper placed on the floor or table to receive waste and use a fresh piece. When the dressing is completed burn the newspaper and its contents.

Do not wash the wound itself if it has bled freely and if no dirt has been ground into it. But if the wound contains dirt, as is often the case when a child has fallen in the dirt or gravel, the dirt must be washed out. To do this flush the wound freely with sterile water from a clean pitcher,

or directly from the teakettle or pan in which the water has been boiled and then allowed to cool. Dirt that sticks in the wound may be dislodged with bits of sterile gauze or cotton. Drop each bit, after it has been used, on the newspaper.

After the wound has been thoroughly cleaned apply iodine, 3½-per-cent solution, well down into the wound and also to the skin for from one-half to one inch around the wound. Iodine should be allowed to dry before covering the wound with a dressing. Putting on a dressing when the iodine is wet may result in a severe burn. Pressing the edges of the wound gently together helps to squeeze out all the moisture possible.

To finish dressing the wound, first cover it with a sterile-gauze pad or freshly ironed cloth. Do not allow the surface of the pad which is to touch the wound to come in contact with your fingers, the table, or anything else. Bind the pad firmly over the wound with gauze or strips of clean cloth and fasten it with adhesive tape or safety pins. If the wound is small, a bit of sterile gauze may be placed over the cut and strips of adhesive used to hold the gauze in place. Do not allow the adhesive to touch the wound.

A small wound or a scratch should be squeezed gently to encourage bleeding. This helps to clean out the wound so that washing with water is unnecessary. If the wound is a mere scratch, it may be painted with iodine and left uncovered. Deep puncture wounds made by a splinter, nail, or a sharp-pointed instrument should be encouraged to bleed freely and cleaned out as well as possible with an antiseptic. The wound should then be shown to a doctor who will open and sterilize it. If the doctor thinks it advisable, he will give the injured person an injection of antitetanus serum in order to avoid the possibility of tetanus.

To remove a splinter which is not embedded deeply, first paint the skin with iodine, then sterilize the needle or other

Figures *a* and *b* show how to bandage one finger.
Figure *c* shows how to bandage two fingers.
Figure *d* shows the completion of a bandage for the whole hand

instrument to be used by boiling it in water for five minutes. Remove the splinter, squeeze the wound to make it bleed, wipe it dry with sterile gauze, and apply iodine again.

A wound made by the bite of a dog or some other animal is no more dangerous than any other wound unless the animal has a disease called rabies. Such an animal is said to be rabid, or "mad." The bite of a mad dog or some other rabid animal is extremely dangerous even if the wound is no more than a mere scratch. Rabies can be kept from developing after a mad-dog bite bv the Pasteur antirabic treatment.

In case of animal bite let running water flow over the wound to wash out the animal's saliva. Then go immediately to a doctor to have the wound dressed. Tell the doctor all the circumstances of the accident, so that he can investigate. He will decide whether it is advisable to start the Pasteur treatment for protection against rabies at once or whether it is safe to wait for a report from the department of health on the biting animal.

KEEPING BABIES AND SMALL CHILDREN SAFE

Until children are old enough to understand the reasons for doing or not doing certain things, it is very important to keep dangerous objects out of reach and to keep children away from dangerous places. Play pens for the house and for the porch or yard are a necessity. Placed in one of these the baby can play safely and happily with his toys while Mother is busy. Safety gates for the head and foot of stairs are another requirement if there are small children in the home. Bars across the lower sections of windows, and strong hooks for screens will prevent falls when little people get to the climbing stage.

ARE YOU DOING YOUR BEST TO MAKE YOUR HOME SAFE?

Do you inspect all the different parts of your home frequently and correct promptly all the unsafe conditions you find?

Do you practise doing everything in a safe skilful manner and avoid actions which you know are unsafe?

Is there a fire-extinguisher in your home, and do all the older members of the family know where it is kept and how to use it?

Do you know the location of the fire-alarm box nearest your home and how to turn in an alarm?

Do you have fire drills at home?

Do you cleanse properly all cuts and scratches no matter how slight and use an antiseptic, and do you cover all wounds except minor ones with a sterile dressing?

Are you making an effort to learn and to practice the first-aid measures for severe bleeding, stoppage of breathing, poisoning, burns, fractures, choking, and other injuries?

If there is a baby or a small child in your home do you keep dangerous objects out of his reach and keep him away from dangerous places?

Are you helping to teach young children to be skilful and self-reliant and to form habits of safety?

1. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. It is important to call a doctor besides rendering first aid to the victim of an accident.

b. A person suffers from shock after nearly all types of accidents, but this requires no special treatment.

c. It may be dangerous to use old iodine as it weakens with age.

d. Every container in the medicine cabinet should be clearly labelled.

e. In disconnecting an electric toaster, the plug should be pulled from the toaster socket.

f. One should never turn an electric light on or off when the hands are wet.

g. A gas stove should not be left unattended when a burner is lit.

h. About 15 per cent of the gas discharged through an automobile exhaust pipe is carbon dioxide.

i. To be on the safe side, always stop and look at the label twice before taking any medicine.

j. "Do as I *say*, and not as I *do*" is a good safety slogan for an older person to use in teaching little children safe practices.

2. Choose the best ending for each of the following sentences. (*Do not write in the book.*)

a. If a person has stopped breathing as a result of drowning, electric shock, gas poisoning, or choking, nothing whatever must be allowed to delay · (1) giving artificial respiration · (2) running for help · (3) administering stimulants.

b. If a person has taken a poison, the thing to do *immediately after calling the doctor* is · (1) try to remember, or hunt for, information concerning the proper antidote · (2) give large quantities of lukewarm water in order to cause vomiting · (3) give something to soothe the irritated surfaces of the throat and stomach.

c. To stop bleeding from a wound in which an artery has been cut, pressure should be applied at · (1) the pressure spot which is nearest to the wound and between the wound and the heart · (2) the pressure spot which is nearest to the wound on the side away from the heart · (3) the pressure spot along the artery which is nearest to the heart.

d. When it is necessary to apply a tourniquet · (1) the tourniquet must be twisted as tightly as it is possible to twist it · (2) the tourniquet must be loosened every ten or fifteen minutes until the doctor arrives · (3) the tourniquet must not be loosened before the doctor's arrival.

e. The best substance to put on a raw sensitive burn is · (1) vaseline · (2) a solution of baking soda or tannic-acid powder in water (3) iodine.

THINK ABOUT THESE QUESTIONS

1. We do not expect accidents to happen, and this is a good thing. If we tried to avoid doing things, such as crossing a street or taking a bath, the doing of which has been the occasion of many accidents, we should at last find ourselves doing nothing at all. There are very few actions which at one time or another have not been the occasion of an accident. Since this is so, what in your opinion are some of the ways in which people may make themselves accident-proof?

2. Why is it important for boys and girls to learn how to recognize unsafe conditions in the home, even though there may be some unsafe home conditions which are now beyond their power to remedy?

3. What are some of the ways in which you may help little children to grow up into courteous, careful, law-abiding citizens?

4. What facts about the circulation of the blood are demonstrated by the symptoms of bleeding from an artery and the symptoms of bleeding from a vein?

5. Why is it important not to move a person with a broken arm or leg until a splint has been applied? Why should a person with a broken back be moved *only* under the supervision of a doctor?

6. Why are restoration of breathing in a person who has stopped breathing, the control of severe bleeding, and inducing vomiting in a person who has taken poison first-aid measures which demand immediate application?

DO THESE THINGS

1. Accidents happen usually because some thing is at fault (mechanical factor) or because some individual is at fault (personal factor) or because both are at fault. Each time an accident happens in your home, no matter how slight, make a study of it. Then write a report which tells the type, or nature, of the accident, what the injured person was doing at the time of the accident, what mechanical factor, if any, was involved; what personal factor, if any, was involved; and finally how the accident could have been prevented. The collection of such reports may be made a class activity and a discussion of them a part of the safety-education program of the class.

2. As a class activity collect newspaper stories about accidents which occur in your community. From the story try to make reports similar to the one outlined in project 1 and discuss the reports in class.

3. Visit a department store and make a list of toys for young children offered for sale. Mark with a star those you consider safe. Be prepared to tell in class why you think they are safe.

4. Make a survey of your home. For each part of the home (kitchen, bathroom, stairs, hallway, etc.) draw up a list of the measures that should be taken to make that part of the home safe. Make a list of various safety devices that your home needs, such as a bath mat, a fire screen, etc. Can you think of any way in which you might earn the money to buy such articles? Would one of them make a good Christmas or birthday gift for your father or mother?

UNIT XIV

Alcohol and Tobacco on Trial

A narcotic drug is a substance which has a powerful dulling effect on the nervous system. Alcoholic beverages and smoking tobacco both contain narcotics to a greater or less degree. As the use of these may have serious consequences, every person ought to know the answers to certain questions about them before deciding to drink or smoke.

DO YOU KNOW

Why alcohol weakens self-control?

How drinking alcohol affects driving a car?

Whether alcohol can cure disease?

Whether the taxes collected on the sale of alcohol are a benefit to the nation?

Why young people should wait until they are twenty-one before deciding whether or not to smoke?

Ethyl alcohol is the scientific name for the substance in beverages such as wine, beer, whisky, brandy, and gin which causes the effects on the body known as intoxication. It is a poison and will cause death when there are more than five parts of alcohol to one thousand parts of blood in the body. Ethyl alcohol is produced by the action of yeast cells on a liquid containing either sugar or a starch that may be turned into sugar.

In nature wild yeast cells in the air and in the soil cause the fermentation and decay of ripe fruits and vegetables. When fruit juices, crushed grains, and grain sprouts mixed with water are placed by man in a vat or tub, the yeast cells sink deep down into the liquid and fermentation begins. The process of fermentation depends upon the need of the yeasts for oxygen. In a fermentable liquid, that is, a liquid containing sugar, a ferment in the yeast breaks up the sugar to get at the oxygen it contains. When the yeast has extracted the oxygen from the sugar, carbon dioxide and ethyl alcohol are left. The carbon dioxide is what makes the bubbles in alcoholic beverages, such as wine or beer. The ethyl alcohol is what makes the beverage intoxicating.

How Does Alcohol Affect the Body?

Ethyl alcohol usually is taken into the body as an ingredient of an alcoholic beverage. It is readily absorbed from the digestive tract and begins to appear in the blood stream within a few minutes after being taken. Unlike natural foodstuffs, except simple sugar, alcohol does not have to be digested in order to pass from the digestive tract into the blood stream. Shortly after a person has

drunk an alcoholic beverage, all the organs of his body become bathed in blood containing alcohol. The alcohol continues to exercise its effects until the larger part is oxidized, that is, burned up by the body cells. The small remainder is sent out of the body by way of the kidneys and the lungs.

The chief effect of alcohol is on the nervous system. It always acts as a depressant upon the brain, never as a

Grapes are a delicious food.
When turned into wine, most of their food value is lost

Doris Day

stimulant. A depressant is something that slows down one or more body activities. A stimulant is something that speeds up one or more body activities. It was once believed that alcohol stimulated the brain because drinks containing it seem to make people livelier. But now we know that the reason why people seem gayer after taking one or more drinks is because alcohol depresses, or dulls, the parts of the brain that have to do with self-control.

The brain is the seat of all our thinking processes and of all our conscious behaviour. The depressant effect of alcohol on the brain is to remove the influence which the higher brain centres have over our thinking processes and our behaviour. As a result worries and anxieties are blotted out of the mind. After a few drinks a person no longer feels restrained by social customs. He loses the power to criticize himself. He is less keenly aware of his surroundings, and his judgment becomes less acute. In this condition a drinker very often does and says things he would never dream of doing or saying if part of his brain had not been dulled. If he continues drinking, his thoughts and speech and movements become confused.

The effect of alcohol on nervous tissue is believed to be due to the fact that the fatty substances in the nerve cells readily absorb alcohol. The presence of alcohol at the junction of the sensory and motor nerve cells in the brain and spinal cord appears to have the effect of short-circuiting, or blocking, the passage of nerve impulses along their regular routes. The general situation is such as might happen in a big railroad yard if the switchman (representing the higher brain centres) was asleep and the switches (representing the junctions of sensory and motor cells) were not set correctly. Incoming and outgoing trains (represent-

Does this girl have good control over her muscles? How does th presence of alcohol in the brain spinal cord affect muscle conti

Black Star

ing may cause a driver to make mistakes because even the slightest delay in responding to danger signals received by the eyes and ears may cause an accident.

Does Alcohol Lessen Fatigue?

The fatigue, or tiredness, you feel after using your muscles in hard work or play comes from two things: (1) the accumulation in the body of waste substances that act as poisons and (2) a loss of food material used up by the muscles as they work. Rest gives a chance for the blood to carry the fatigue substances to the kidneys and the lungs for removal from the body, and also to carry fresh supplies of food substances to the muscles.

Some people think that an alcoholic drink lessens the feeling of fatigue because of the pleasant feeling of relaxation which results from the depressant effect of alcohol on the brain. A tired person who has taken a drink may think that he can do more and better work because, for the moment, he feels refreshed. But the opposite is true.

Alcohol in the blood slows up the processes by which the body gets rid of the waste substances produced during hard exercise. Thus instead of helping to lessen fatigue, alcohol actually increases it. The "hang-over" (which is the expression used to describe the headache and the feeling of wretchedness experienced after recovery from a heavy drinking spree) is caused by the piling up of waste substances in the blood stream.

Sir Frederick Treves, a famous British surgeon who served during the Boer War in South Africa, tells this story as an illustration of the effect of alcohol in increasing fatigue. An English army was hurrying from the seacoast to relieve the city of Ladysmith, many miles away, where another body of English soldiers was holding out

against capture. The marching soldiers suffered severe hardships, partly because they were obliged to hurry in the midst of hot weather to which they were not accustomed. Sir Frederick Treves said of them: "In that enormous column of thirty thousand men, the first to drop out were not the tall men, or the short men, or the big men, or the little men; they were the drinkers; and their dropping out was as clear as if they had been labelled with a big letter D on their backs."

The reason why athletes are not allowed to use alcohol while in training is because they cannot expect to win if they tire quickly. Candy and sugar are the best sources of a quick supply of energy. This is why ballplayers, mountain-climbers, and other athletes often suck sugar lumps or eat chocolate.

Does Alcohol Help People to Work Better?

Many people think that they work harder and more skilfully after taking a drink containing alcohol than they did before. There is nothing to show that this is true in the studies made by scientists of the effect of alcohol on muscle control, learning and memory, attention and concentration, and thinking and reasoning. Some of the tests by which scientists have shown that alcohol lessens rather than increases the ability to work rapidly and accurately are very interesting.

For instance, two British scientists wanted to test the effect of alcohol on self-control and on the ability to pay close attention. They used a machine called a dotting machine. A small opening was made in the top of a desk. Underneath was a roll of paper tape which was

"The top at last! Would these mountain-climbers look so fresh and happy if there had been whisky instead of water in their canteens?"

Galloway

rapidly moved along by clockwork. There were twelve hundred small red circles and about ninety blue circles printed on the tape. As the tape moved, the circles appeared in the opening one at a time.

With a pen held in her right hand the person being tested was supposed to dot each red circle as it appeared in the opening. She was to leave the blue circles undotted, but she was required to make a mark on the tape with a pen held in her left hand in order to show that she had recognized the blue circle and had purposely left it undotted. She had only a fraction of a second in which to decide whether to dot or not to dot. Because there were so many red circles the natural impulse was to dot; so self-control was needed to avoid dotting the blue circles.

Different quantities of alcohol were given during the experiments, all the way from the amount of alcohol in a little less than three tablespoonfuls of strong wine to slightly less than the amount in seven tablespoonfuls. Even with the smallest amount of alcohol there were 21 per cent more mistakes made on the days that alcohol was taken than when none was taken. With the largest amount of alcohol there were 131 per cent more mistakes. Alcohol weakened the ability to pay attention to work that required quick and accurate decision. It also lessened the power of control.

Is Alcohol "Good Medicine"?

The use of alcohol as medicine began many years ago when very little was known about the effect of drugs. As alcohol made sick people feel better, it seemed natural to believe that it helped to cure them. But at last it was proved that most of the claims made for the value of alcohol as a medicine are not true. Many physicians now believe that there are very few conditions that are helped by the

use of alcohol. So many better methods of treating illness have been discovered in recent years that the wide use of alcohol in medical practice no longer exists.

Snake bite, for example, is no longer treated by forcing the victim to swallow large quantities of whisky. The alcohol in the whisky has no effect on snake venom. Brandy or whisky was formerly used to revive a person who had fainted. It was the burning taste of the liquor that roused the patient. Today we know that the smell of ammonia, or even the smell of a burnt feather, will have the same effect.

Many people think it is a good thing to take a drink of whisky or gin to keep from catching cold. But alcohol really makes the body cooler, although the drinker feels warmer. Alcohol in the blood causes the blood vessels in the skin to dilate, that is, become larger. Hence more blood passes from the warm interior of the body to the enlarged vessels in the skin. The nerve endings in the skin report a sensation of warmth to the brain, and the person thinks that he is warmer. Instead, the increased volume of warm blood in the skin leads to the radiation of more heat from the body and therefore to a lowering of the body temperature. Pneumonia is more frequently found among those who drink alcoholic liquors than among those who do not.

Pharmacists often use alcohol in making up medicines prescribed by doctors because many drugs that cannot be dissolved in water will dissolve in alcohol. Used in this way alcohol is very valuable. But many ready-mixed medicines which may be purchased without a doctor's prescription contain a great deal more alcohol than is required to dissolve the drugs used. As alcohol tends to deaden feelings of discomfort, this doubtless explains the wide use of patent medicines of this kind. Such medicines fool people into thinking that they are being cured. The great danger in

their use lies in the fact that they may cause the patient to delay too long in seeking the treatment he really needs or that he may form a habit that will be hard to break.

Is Alcohol Nutritious?

Alcohol can do only one thing that a food can do; it supplies energy which is available as heat and as fuel for work. It cannot, like the common foodstuffs, become part of the body either as tissue or as material stored for future use. For this reason it would be more exact to call alcohol a fuel rather than a food. But although alcohol burned in the body supplies energy, this energy costs more in dollars and cents than does the same amount obtained from true foods. It would cost you four and a half times as much to buy a certain number of calories' worth of energy in the form of beer as it would to buy it in the form of milk. Then, too, milk not only provides energy but it also supplies practically all the essential food elements needed by the body. Although fruit juices are not so rich in food value as milk, they are a good source of sugar and vitamins. But when fruit juices, such as grape juice or apple juice, are turned into alcoholic beverages, they lose a large part of their nutritive value.

The most telling argument against using alcohol as a food is the fact that it weakens the normal working ability of the body. Doubtless poisonous mushrooms and poisonous berries of various kinds have food value, but we do not call them foods because they do more harm than good. Although alcohol supplies the body with a certain amount of energy, we may not call it a food, because its fuel value is more than offset by its depressant effect on the nervous system.

Does Alcohol Have Any Effect on Length of Life?

Once in a while we read in the newspapers that someone who has lived to a good old age has used alcoholic beverages freely all his life. This, of course, is no proof that the average person would not have his life shortened by the continuous use of alcoholic beverages. It is only the exceptional person who lives to be ninety years old or more, and a great many other factors besides drinking or not drinking whisky or beer may account for his achievement. We can-

Why does a pharmacist sometimes find alcohol useful in making up a medicine prescribed by a doctor?

Black Box

not write out a recipe for long life as we can write out a recipe for a cake, although some old folks like to think that one thing or another is the secret of living to great old age.

One of the principal sources of information regarding the effect of alcohol on length of life is the records of reliable life-insurance companies. In applying for insurance a person is asked whether he uses alcoholic beverages and, if so, to what extent. It is possible, therefore, for an insurance company to classify policyholders as nondrinkers, moderate drinkers, and excessive, or heavy, drinkers.

The records show that on the whole total abstainers, that is, those who never touch alcohol, live longer than do nonabstainers. Those who report that they drink moderately —an average of two glasses of beer or one glass of whisky a day—are shorter-lived than the average person. This is due partly to the fact that a certain percentage of people who say they are moderate drinkers when they apply for insurance become heavy drinkers later on. In other words, some people who start by drinking only a little end by drinking a great deal. Those who drink to the point of intoxication are distinctly shorter-lived than the average.

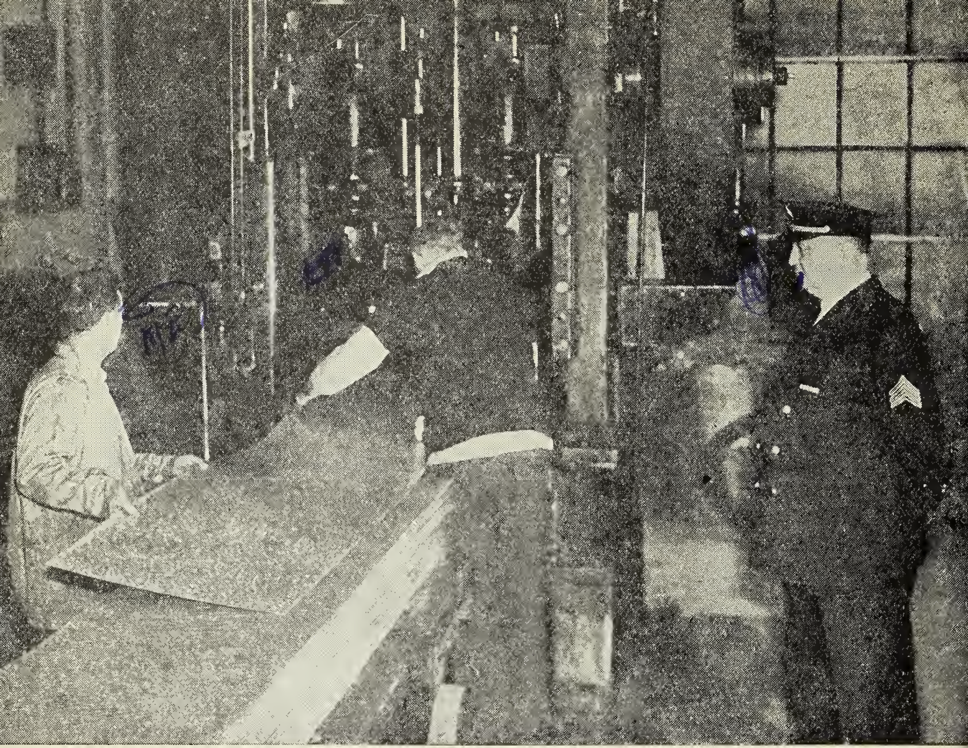
Is Alcohol a Help or a Burden to the Community?

One argument for the licensed sale of alcoholic beverages is that the taxes collected on their manufacture and sale are a big source of government revenue. Taxes are imposed and used to meet the expenses of government. If the sale of a taxed commodity increases government expenses beyond the amount of the taxes imposed on it, then the sale of the commodity means money loss to the government instead of money gain. Part of the expense of government is the support of courts of law, police departments, prisons, re-

formatories, poorhouses, institutions for the insane and mentally defective, public relief of poverty, and some hospitals. Does the sale of alcoholic beverages cost the government more than it receives in taxes on alcoholic beverages by increasing government expenditure for law enforcement and for the care of the poor, the mentally defective, and the sick?

It is very difficult to trace a direct relationship between the misuse of alcohol on the one hand and vice and crime on the other. It may be said that a person who has committed theft or murder or some other crime while under the influence of alcohol would have done it anyway. He might be a criminal by nature or a criminal because of his bringing up or his surroundings. The general opinion among scientists seems to be that while it may be impossible to place all the blame on alcohol for a major criminal act, such as planned murder or robbery committed under the influence of alcohol, there is undoubtedly an indirect relationship in a great many cases. Certainly anything which disturbs the normal working of body and mind, as alcohol undoubtedly does, may result in a situation from which a criminal act may spring.

There is no question as to the relation between the misuse of alcohol on the one hand and disorderly conduct, minor offenses against the law, mental defectiveness, and poverty on the other. If the breadwinner of a family is a heavy drinker, it is almost impossible to have a happy home life. Money which is needed for food, clothing, shelter, recreation, and the education of the children is likely to be spent in helping one person to forget his responsibilities. It often happens that a habitual drinker loses his job because the use of alcoholic beverages has lessened his skill or has made him careless about his work. A drunken person is not a pleasant person to have around. Too much alcohol may



Occupation in a prison. Prisons and reformatories are paid for by taxes. Why does the sale of drinks containing alcohol cost the government more than it receives in taxes on such beverages?

make the drinker quarrelsome or cruel or silly. A person in a drunken stupor, or heavy sleep, is a disgusting spectacle.

No matter what arguments may be advanced on the side of moderate drinking, remember always that moderate drinking may lead to heavy drinking and that one drunkard in a home is enough to wreck the happiness and the self-respect of the family. It has been estimated that from 15 per cent to 25 per cent of the homes helped by charity in times of prosperity were in distress because of the intemperate use of alcohol by some member of the family.

It is foolish to say that the revenue received by the government from the sale of intoxicating liquors benefits the

government. The gain is more than lost in the cost of trying to cure the social ills, crime and vice and poverty, that arise from the misuse of alcohol.

TOBACCO ON THE WITNESS STAND

The appeal of tobacco-smoking, like that of alcohol-drinking, is produced by the effect which a narcotic has on the nervous system. However, the narcotic effect of tobacco smoke is not nearly so powerful as that of alcohol. The habitual smoker may smoke all during his waking hours without noticing any particular difference in the way he feels. It is only when he cannot smoke that he notices the difference smoking makes. Then he is likely to feel fidgety and nervous until he is able once more to light a cigarette or cigar or pipe. The smoke from the tobacco has a relaxing effect which the habitual smoker misses when he is deprived of it. Tobacco, therefore, is a tyrant. It is a mild tyrant compared with alcohol, but even so it has the power to make its users uncomfortable when for some reason they are not allowed to smoke.

Tobacco smoke is a very complex mixture. The substance that gives it its narcotic effect is nicotine. This drug has a definite toxic, or poisonous, influence on the heart. Young people are more sensitive to it than are adults. It disturbs the normal rhythm of the heart by making it beat too fast or skip beats, and it interferes with the efficiency of the nervous system. There is about six tenths of one per cent of nicotine in tobacco smoke, much of which is absorbed by the body of the smoker. In puffing, about 66 per cent is absorbed; in inhaling, about 88 per cent.

Tobacco smoke is irritating to the delicate lining of the nose and throat. A husky voice and an annoying cough are

sometimes caused by excessive smoking. Because smoking often interferes with breathing, athletes in training are forbidden to smoke. It is impossible to be a good runner or a good swimmer or a good climber if one quickly gets out of breath.

Tobacco smoke may dull the senses of taste and smell. Food does not taste so good to the habitual smoker as it does to people who do not smoke. In some cases chronic indigestion has been caused by excessive smoking, because of the effect of tobacco smoke on the glands in the mouth and stomach that secrete digestive juices.

Nicotine hurts some people more than others. It may cause for such people headaches, irritability, or sleeplessness. In some cases it has led to serious eye troubles and to nervousness. Other harmful substances in tobacco smoke irritate the membranes. Thus smoking may result in catarrhal conditions of the nose, throat, and bronchial tubes or in a chronic cough ("smoker's cough").

Normally the heartbeat is slow or fast according to the needs of the body. Nicotine may disturb the nervous control of the heart. Irregularity in the heart action and a quickening of the heartbeat ("tobacco heart") may result. The nerves controlling the breathing muscles also are affected by nicotine. Breathing then becomes more difficult during exercise.

Tobacco was unknown to the civilized world up to the time of the discovery of America. Early explorers of America took tobacco to Europe. The habit of smoking tobacco soon began to spread all over the world. Many people tried to stop its use. In Russia in the seventeenth century the noses of smokers were cut off. James I of England called smoking "a custom loathsome to the eye, hateful to the nose, harmful to the brain, and dangerous to the lungs." Since the days of Columbus and James I

people have argued against the use of tobacco, and scientists have shown them to be right.

Fortunately for those who smoke, so little of the nicotine finds its way into the blood that there is no danger of its causing death directly, although it may injure the body and thus become one of the causes of death. Adults who limit themselves to smoking a few times a day may not be harmed by tobacco. But heavy smoking is likely to be harmful and even dangerous.

Sometimes a doctor orders a person not to smoke or to smoke less because the heart or the nerves have been injured by the drugs in the tobacco. Perhaps a young man or woman who smokes may want to get on an athletic team in college. Athletes are not allowed to smoke because of possible injury to the heart or the breathing muscles. Many employers do not allow their employees to smoke while on duty. If a person is used to smoking a great deal, it is hard for him to stop smoking when for any reason it becomes necessary to give up the habit.

Because smoking appears to have a much more serious effect on growing boys and girls than it has on adults, a very sane rule to follow is the traditional one that says young people should not smoke until they are twenty-one. Then they may decide for themselves whether to smoke or not. In making this decision it is well to remember these facts: Tobacco-smoking is unnecessary. It is expensive. It carries with it the known danger of possible injury to the normal functions of the body. It is a drug habit, and, like any drug habit, it becomes a tyrant. Besides these indictments you may add that it is an unnatural habit which may at times become very inconvenient.

ARE YOU DOING YOUR BEST TO REACH AN INTELLIGENT DECISION CONCERNING THE USE OF ALCOHOLIC BEVERAGES, TOBACCO, AND MEDICINE?

Have you made up your mind to wait until you are twenty-one before deciding whether or not to drink or smoke?

When in doubt about any course of action do you think of the possible consequences?

Are you learning to practice self-control in everything that you do?

Are you using your knowledge of the body and its care to consider carefully the claims made in patent-medicine advertising?

Do you avoid self-medication?

TRY THESE TESTS

1. Match each word or group of words in the box with the word or group of words in the list below the box that you associate with it. (*Do not write in the book.*)

the nervous system	depressant
fatigue	patent medicine
alcohol	carbon dioxide and ethyl alcohol
nicotine	abstainers
yeast cells	

the substances remaining in a sugar solution after yeast cells have extracted the oxygen
something that slows down one or more body activities
the part of the body chiefly affected by alcohol
the cause of fermentation in ripe fruits and vegetables
people who never drink alcoholic beverages
the narcotic drug in tobacco smoke
the result of accumulation of poisonous body wastes and loss of food material
a fuel rather than a food
a special mixture of drugs that one individual or company has the exclusive right to make and sell

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. Carbon dioxide is the substance in whisky that causes intoxication.

b. Beer is a stimulant.

c. The alcohol in an alcoholic beverage weakens self-control.

d. A very small amount of alcohol may cause the driver of an automobile to make a fatal error in handling his car.

e. A tired person can do better work after taking a drink of whisky.

f. Alcohol lessens the power of paying attention to work that requires speed and accuracy.

g. A big drink of gin or whisky will ward off pneumonia after a severe chill.

h. Alcohol is no longer used widely as a medicine.

i. People who drink heavily live longer than people who do not drink.

j. The taxes collected on the sale of alcoholic beverages are a good source of government revenue.

k. Young people are more sensitive to tobacco smoke than are adults.

l. It is safe to drink moderately.

m. Tobacco smoke affects both taste and smell.

n. Excessive smoking may cause chronic indigestion.

THINK ABOUT THESE QUESTIONS

1. What is meant by self-control? How does the drinking of beverages containing alcohol affect self-control?

2. What happens to the food value of a fruit juice when it is turned into an alcoholic beverage? Why is it logical to call alcohol a fuel rather than a food?

3. Does the government of a country really profit from the taxes collected for the sale of alcoholic beverages? What are the reasons for your answer?

4. Oliver wishes to be an athlete when he goes to college. Some of his friends smoke, and Oliver is tempted to begin smoking, too. What are some arguments that might influence Oliver in making up his mind whether to smoke or not to smoke?

5. Ask some man who smokes how much his tobacco costs per week. How much will it cost for a year? If the money spent for tobacco were invested at 5 per cent per annum, how much money would he have in ten years?

6. Why does a person or a company find it profitable to manufacture, advertise, and sell a patent medicine? To what fundamental desires of human nature do patent-medicine advertisements appeal? Why do doctors never prescribe drugs the effects of which on the human body they do not know? Why is it dangerous for people who have not studied medicine to prescribe or to take drugs or mixtures of drugs on their own responsibility?

DO THESE THINGS

1. Do the following experiment in order to compare the effect of water on fats and the effect of alcohol on fats. Fill one bottle two-thirds full of water and label it *A*. Fill a second bottle two-thirds full of alcohol and label it *B*. Note that both liquids are alike in appearance. In what ways are they not alike (smell and feeling on hand)? Put an equal amount of a fat (suet, olive oil, lard, or butter) into each bottle, and watch results. Note what effect alcohol has on the fat and what effect water has on the fat. Find out ways in which alcohol is valuable commercially because of its ability to dissolve what water will not dissolve. What is the probable effect of alcohol on the fat-coated nerve cells?

2. Do the following experiment to show the effect of alcohol on water. Pour water into a small bottle until it is half full. Then fill the bottle to the brim with alcohol. Close the opening of the bottle with your finger and shake. Notice what happens. Find out the meaning of the word *dehydrant.* Find out some of the commercial uses of alcohol as a dehydrant. Find out the effect of alcohol as a dehydrant on the moist tissues of the body. Why is a person likely to feel very thirsty after recovering from a drinking spree?

3. As a class activity collect newspaper stories about automobile accidents which took place because a driver or a pedestrian had been drinking. Explain why drinking even a small amount of an alcoholic beverage may increase the liability to accidents on the part of a driver or a pedestrian.

4. As a class activity collect pictures which members of the class think illustrate qualities that a leader in business or in athletics must possess. Label each picture with the name of the quality that stands out, as alertness, skill, speed, courage, sportsmanship, etc. Discuss in class the effect that heavy drinking may have on the dimming of such qualities.

5. Write and act a play in which the hero is a young boy who is tempted to start smoking cigarettes. Create a situation in which the hero is presented with arguments for and against smoking before the age of twenty-one.

6. As a class activity have a trial in which ethyl alcohol or some other narcotic drug or a patent medicine is the defendant. A committee of the class may visit a local court of justice to find out what the procedure should be. This information also may be obtained by interviewing a judge or a lawyer or from books and newspapers.

Have a judge, a jury, a prosecuting attorney, a lawyer for the defence, witnesses for the defence and for the prosecution, the necessary court officials, and a guard for the defendant. If you have a school newspaper, reporters should be present to write the story of the trial.

In taking testimony from the witnesses the lawyers on both sides should bring out all the arguments for and against the defendant. The judge must then sum up the testimony for the jury, and the jury after considering the facts as brought out by the witnesses will render a verdict of guilty or not guilty. According to the verdict the judge will either dismiss the defendant or pass sentence.

A trial of this kind has been held in many schools. It may be used for a school assembly program, or it may be given before a meeting of a parent-teacher association or some other community group.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or terms:

narcotic drug	depressant	toxic
ethyl alcohol	perception	excessive
fermentation	abstainer	intoxicating
oxidize	nonabstainer	venom
stimulant	stupor	dehydrant

2. Tell the difference between the following words or terms:

stimulant and depressant	sensory cell and motor cell
abstainer and nonabstainer	narcotic and nicotine

INDEX

Key to the Sounds

ă *as in* at	ē *as in* be	ŏ *as in* not	ou *as in* out
ā *as in* ate	ẽ *as in* her	ō *as in* note	o͝o *as in* foot
á *as in* ask	ĭ *as in* bit	ô *as in* horse	ŭ *as in* us
ä *as in* father	ī *as in* bite	oi *as in* oil	ū *as in* use
ĕ *as in* bet			o͞o *as in* food